SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 8. [NEW SERIES.] NEW YORK, FEBRUARY 23, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

LIQUEFACTION OF GASES—CAILLETET'S EXPERIMENTS.

We recently laid before our readers full details of the very important experiments made by M. Raoul Pictet, which resulted in the liquefaction of oxygen, air, and other gases hitherto supposed to be permanent. We also noted that simultaneously with M. Pictet, who carried on his investigations in Geneva, M. Cailletet, of Paris, had experimented in the same direction, though by different means, and had obtained similarly successful results.

M. Cailletet is engaged in iron manufacturing, and his researches were conducted at his foundery at Châtillon-sur-Seine. The apparatus used by him is represented in the annexed engravings, for which we are indebted to *La Nature*. A hollow steel cylinder, A, Fig. 1, is solidly fixed on a cast iron frame by the straps, B. This is filled with water, and entering it is a soft steel plunger, to the extremity of which is attached a heavily-threaded screw, which enters the bronze nut, F, of the large hand wheel, M. The nut is prevented from horizontal motion and is held in a heavy strap, as shown, so that when it is rotated by turning the hand wheel it causes the screw to move forward or back, and so moves the plunger into or out of the cylinder. A leather washer inside the latter prevents any escape of the liquid within. In order to introduce the water or other fluid to be compressed into the cylinder, it is poured into the receiver, G, which communicates with the interior, the passage being closed at will by a conical steel screw, operated by the hand wheel, O. By this means compressed gases may be suddenly allowed to expand and to produce an intense fog in the capillary tube inclosed in the glass cylinder, *m*. This fog is formed under the influence of the exterior cold produced by the sudden expansion, and is a sure sign of the liquefaction or even congelation of the gases hitherto regarded as permanent. The other portions of the apparatus may briefly be described as follows: *a* is a hollow steel reservoir capable of supporting a pressure of 900 or even 1,000 atmospheres. It is connected to the compression apparatus by a metallic capillary tube. Water, under the action of the plunger, enters this reservoir and acts on mercury, which compresses the gas. *b* is the adjutage which receives the glass vessel which contains the gas experimented upon. A screw serves to fix this piece to the upper part of the reservoir. Fig. 2 shows this arrangement half its natural size. *m* is a glass cylinder containing another cylinder in which is the fine tube in which the gas is liquefied. This capillary tube may thus be surrounded by liquid protoxide of nitrogen and other refrigerating liquids. The exterior cylinder contains moisture-absorbing material so as to prevent a deposit of ice or vapor on the cooled tube, which would hinder observation. *p* is a cast iron tablet which supports the reservoir, *a*. Screws, *d d*, allow of lifting or lowering the reservoir for spectroscopic examination. An adjutage, S, unites the metallic capillary tubes and transmits the pressure to the different parts of the apparatus. N is a Thomasset manometer modified and verified by means of a free air manometer established on a hillside near the laboratory. N′ represents a glass manometer which serves to control the indications of the first mercury apparatus.

Fig. 2.

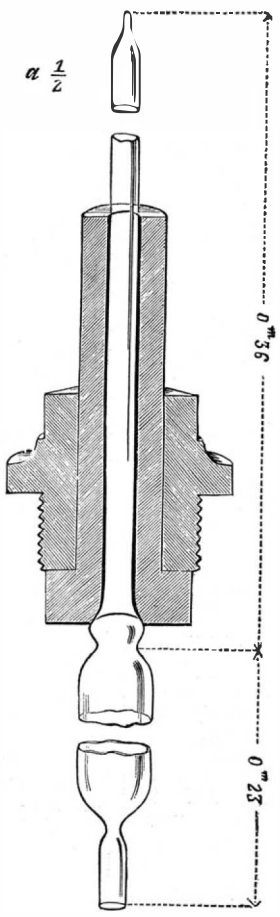
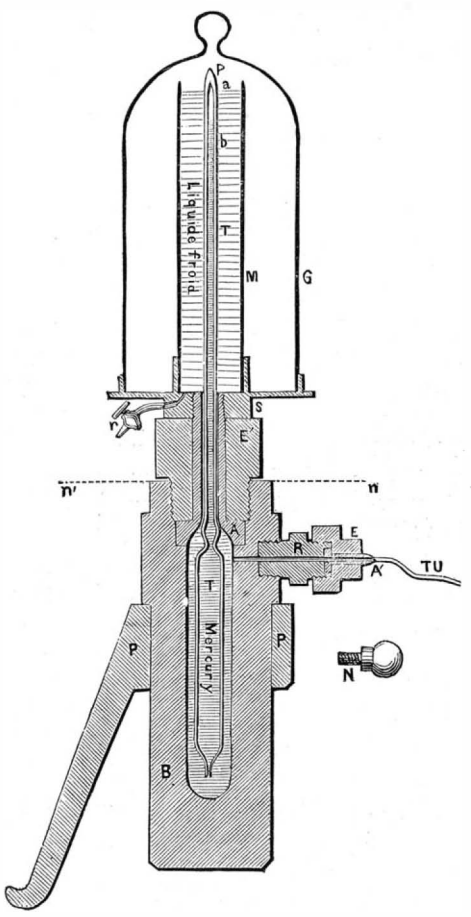


Fig. 3.



No danger attends the use of this machine, as the glass tube in which the gas is compressed presents but a very small surface and would do no harm if it broke.

In discussing these experiments in our former issue we referred to Dr. Andrews' experiments. One of the chief deductions made by him was that there existed for permanent gases a "critical point" of pressure and temperature above which they could not be brought to a liquid state. M. Cailletet's experiments have confirmed this, and proved that for every gas a certain pressure must be combined with a certain lowering of temperature. Neither influence alone is sufficient to produce the desired result, no matter what the intensity may be. M. Cailletet first liquefied nitric oxide. This gas remained gaseous at the pressure of 270 atmospheres and at a temperature of 46·4° Fah. Marsh gas, on the other hand, liquefied at 180 atmospheres and 44·6° Fah.

"If oxygen or pure carbonic oxide be inclosed in the compression apparatus," says M. Cailletet, "if these gases be brought to the temperature of —20·2° Fah. by means of sulphurous acid and under a pressure of about 300 atmospheres,

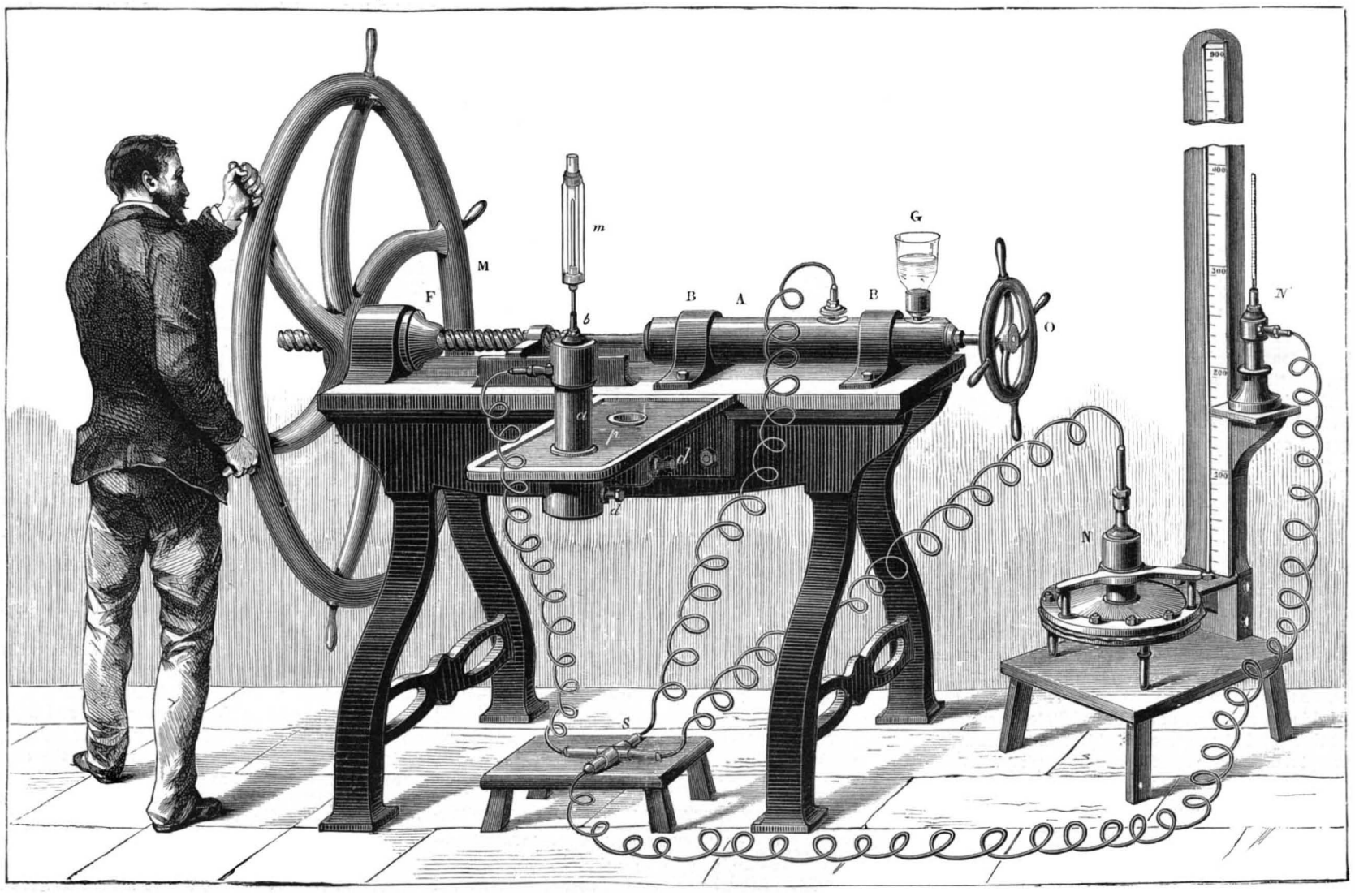


Fig. 1.—CAILLETET'S APPARATUS FOR LIQUEFYING GASES.

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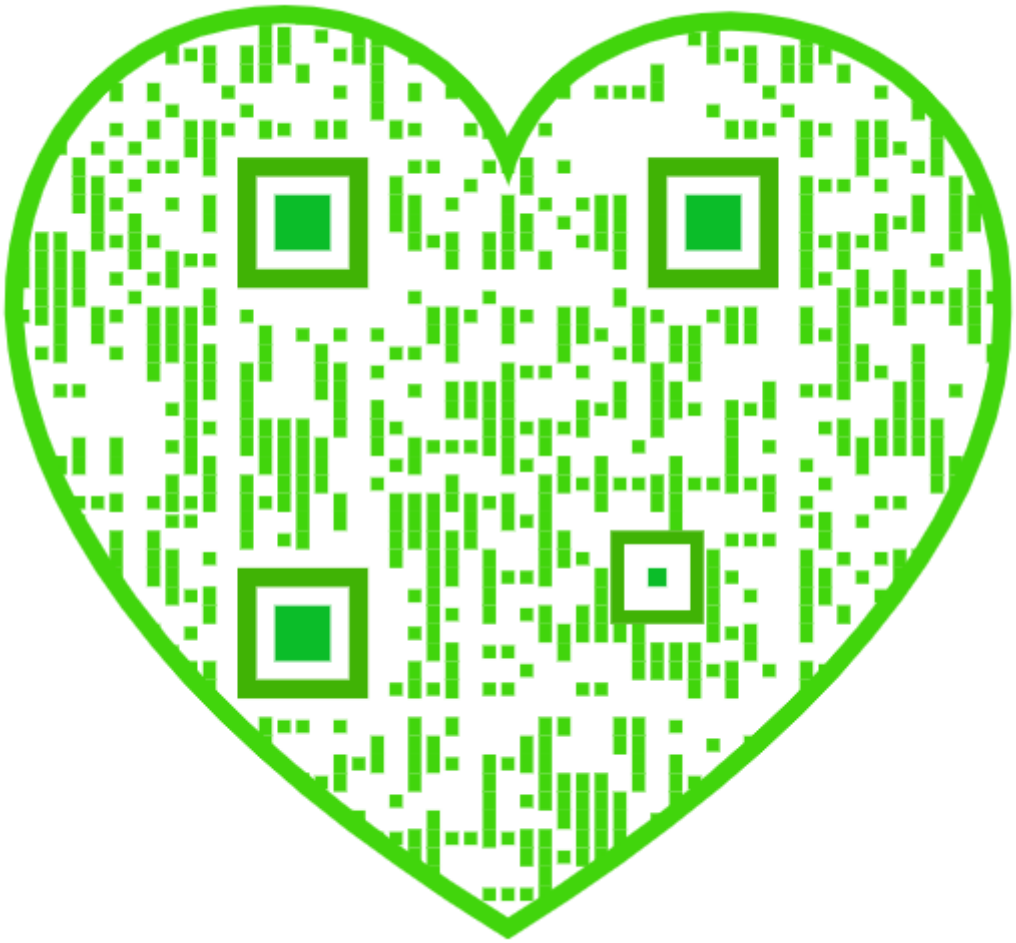

both will retain their gaseous state. But if they be subjected to sudden expansion, which according to Poisson's formula should produce a temperature of at least 392° Fah. below that existing, an intense fog is at once seen, due to their liquefaction and possibly to their solidification. The same phenomenon is observed on the expansion of carbonic acid, and nitrous and nitric oxides when strongly compressed." Shortly after having obtained this result, M. Cailletet announced to the French Academy of Sciences his success in liquefying nitrogen, atmospheric air, and even hydrogen itself, hitherto found the most refractory of all gases. M. Cailletet furnishes the following details to the *Comptes Rendus* of the French Academy:

Nitrogen.—Pure or dry nitrogen compressed to about 200 atmospheres at a temperature of 55·4° Fah., then expanded suddenly, condenses and appears first in the form of spray, in drops of appreciable volume. This liquid disappears gradually, its vanishing beginning at the exterior and extending toward the center, until finally a single vertical column remains in the axis of the tube for a few seconds.

Hydrogen.—This gas compressed to 280 atmospheres and expanded gives a thick fog throughout the entire tube, which however suddenly disappears.

Air.—Atmospheric air was first dried and deprived of all traces of carbonic acid, and then treated as above described. The data of temperature, etc., we have already given in our previous article.

In Fig. 3 is illustrated a small and simple apparatus designed by M. Cailletet, which may be used for exhibiting the liquefaction of gases before a class. It is an exact copy of the parts, *a* and *m*, of the large apparatus shown in Fig. 1. The glass cover is modified and the screw press is replaced by a pump. T T is a glass tube filled with the gas to be compressed, it being previously traversed by a gaseous current until all air is expelled. To this end it is first placed in a horizontal position; when it is full of gas, the end, P, is sealed up hermetically by heat, and the other end is held closed by the finger until it is introduced in the wrought iron device below and enters a cylindrical hollow containing mercury. The upper part of the tube is enveloped in a glass cylinder, M, which is filled with a refrigerating mixture, and over all is placed the bell glass, G. The tube, T U, is connected with the hand compressing pump, which is provided with a suitable manometer. The water compressed by the pump acts on the upper part of the mercury, as shown by the horizontal lines in our figure. The mercury is thus driven into the tube, T T, and reduces the space occupied by the gas. It soons becomes covered with little drops of the compressed vapor, which unite in a liquid mass, *b*.

B is a block of very resistant forged iron; E′ and E are screws which allow of the apparatus being taken apart; A′ is an adjutage; P P, three legged strong support for the apparatus; S, support for the bell, G, and cylinder, M; N, supplementary screw designed to close the aperture, R, when mercury is placed in the apparatus. The large lower portion of the tube, T, being subjected to equal pressure within and without, cannot break, and the only portion open to rupture is the small upper part of the tube, which may be made exceedingly strong. The experiment may, by the electric or oxyhydrogen light, be projected on a screen, when all the phenomena may be followed by the eye without incurring any danger through breakage.

Improved Cow Stables.

Mr. J. Wilkinson, of Harvard, Ill., commenting on the article in SCIENTIFIC AMERICAN SUPPLEMENT, No. 105, p. 1674, entitled "Labor Saving Cows," protests against the use of any such device, as well as against all the other methods in general use for keeping stables clean. He styles them all barbarous, and claims that his plan, which he has advocated for twenty years in various journals (and which we remember having read), is the only perfect one.

His method is to construct an open or latticed floor, through which the solid and liquid excrements fall, the former into a concealed gutter and the latter into a receptacle from which it immediately flows out of the building into a cistern constructed for the purpose. By a system of sub-earth ventilation the excrement lying in the gutter beneath the flow is soon cooled and its surface dried so that all fetid exhalations soon cease. The open floor being always dry and comparatively clean, he dispenses with bedding entirely.

Honors to American Scientists.

Although it has not hitherto been the policy of the Committee on Foreign Affairs to encourage the receiving of decorations and medals by officers of the United States, it recently reported back, with a recommendation that it pass, the bill authorizing Spencer F. Baird, Assistant Secretary of the Smithsonian Institution, to receive from the King of Sweden a diploma and medal, constituting him a member of the Norwegian Order of Saint Olaf, as a testimonial of distinguished scientific service. In the opinion of the committee of Congress, Professor Baird is not an officer of the United States in any such sense that there could be any serious objection to permitting him to accept a diploma as member of a literary organization of a foreign country. The bill was therefore passed.

Professor Hall, of the Naval Observatory, the discoverer of the two satellites of Mars, has bestowed on them the names of "Deimus" and "Phobus," and the Bureau of Navigation of the Navy Department has approved of them. They were suggested, it is said, by Mr. Madan, of Eaton, England, and will probably be accepted by astronomers.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

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VOL. XXXVIII., No. 8. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, FEBRUARY 23, 1878.

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PARADOXES IN STEAM.

It has been stated by some observers that if a watery solution of any salt is heated to its boiling point, the temperature of the vapor or steam of the same will not be equal to that of the solution, but equal to that of pure boiling water. For instance, if a concentrated solution of common salt, which boils at 260° Fah., is evaporated at that temperature, the vapor has a temperature of only 212°, while pure water has only to be heated to 212° to produce the same result.

This statement has been denied by others, claiming that it could not be so, and that the vapor must always have the temperature of the liquid from which it proceeds; but this is a false conclusion, as, contrary to this opinion, it is well established that steam of 260° cannot exist under ordinary atmospheric pressure, but only at a pressure of 3 to 4 atmospheres; under ordinary pressure it must at once expand, and thus by this expansion have its temperature reduced to the corresponding pressure, 15 lbs. to the square inch, and a temperature of 212° Fah.

It follows from this that the steam of salt water is equal to that of fresh water, and the only difference is that in order to raise steam from salt water, its temperature has to be higher than to raise steam of the same pressure from fresh water. The disadvantage of this fact in the production of steam is, however, more apparent than real, because, after once the proper temperature is reached and maintained, the consumption of heat made latent in the steam evolved is 960 units for every pound of water evaporated, whether this water be salt or fresh.

If we invert the experiment and condense steam in saline solutions we find results perfectly in accordance with the above, but quite surprising and even paradoxical at first sight. If, for instance, we send steam of 212° into a concentrated solution of common salt, its temperature will at last be raised far above 212°; if the solution is concentrated so much as to have a boiling point of 260°, it may be heated in this way to 258° or thereabout. It is indeed paradoxical that steam of 212° would be able to raise the temperature of a solution in which it condenses 45° above its own temperature, but such is the fact, and any one can easily convince himself of the reality of these apparently strange results, and it is only the latent heat of the condensed steam which is set free, and part of which shows itself as sensible heat under the circumstances explained.

Soluble salts have strong affinity for water, and will promote the condensation of its vapor, absorb the water, and change the latent heat of the vapor into sensible heat, which latter means a rise of temperature. This action is analogous to that of water absorbing hydrochloric acid gas or ammoniacal gas. In both cases the water becomes very hot, much hotter than the temperature of the gas it is absorbing, and the strong affinity of water for these gases is, as well as the affinity of salt for water, the key to the understanding of all these apparently strange phenomena.

ARCTIC EXPLORATIONS.

There is a fascination about explorations in unknown lands that makes men count as nothing the extremes of heat and cold, hunger, thirst, fatigue, and danger. The mystery which surrounds the polar regions, and the success with which its barriers of ice have guarded its secrets in the past, are maddening to the explorer and geographer. The pole attracts those who yearn to know the hitherto unknown, in the same manner as it attracts the magnetic needle that always points toward it; and notwithstanding the large amount of money spent and the number of lives heretofore lost in Arctic explorations, there are now so many expeditions either organized or organizing for further effort in this direction that it would seem as if the secrets of the polar regions would soon be secret no longer.

In addition to the Howgate expedition, which has already made a start from our shores, other nations are hurrying forward exploring expeditions on a somewhat similar plan. England is about to fit two vessels under Captain Nares, who will operate by way of the east coast of Greenland. Sweden, during the present year, will explore the polar regions by way of Behring's Strait, under the auspices of Professor Nordenskjöld. Holland has determined upon one also. Germany, under the direction of the Arctic Exploration Society, has an Obi expedition, commanded by Captain Wiggins, now on duty. Russia, during the coming spring, will push forward an ethnological expedition, under the Helsingfors professor, to the Vogels and Ostyacs, of the Obi and Irtysh. Besides these expeditions many eminent explorers and scientific societies in different countries are busying themselves in an endeavor to establish stations at different points in the Arctic regions, with a view to those systematic synchronous observations so necessary in making proper progress in the discoveries in meteorological and other kindred sciences.

There is little doubt but that many of the natural sciences might be much enriched by observations directed especially in their directions. Geographical discovery has hitherto been the main point of the expeditions sent out, and while this is no doubt a very important feature, yet there are many others which should receive attention. Usually the expeditions have been so conducted as to preclude anything beyond mere locomotion, all appliances for discoveries in other directions than that of geographical science being left behind.

Under the colony system, or what is now known as the Howgate plan, there is no doubt that many interesting discoveries in various sciences can be made that have hitherto escaped observation under the systems which made locomo-

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tion in a northerly direction almost the only thing sought for. At least, this is the opinion of many scientists, including such men as Professor Loomis of Yale College and Professor Henry of the Smithsonian. Of the practicability of the colony scheme as a means of geographical discovery we may say that it was brought forward as long ago as 1868, by Dr. Hayes, the Arctic explorer, who still believes in it; that it was a favorite idea of Captain Hall, who would, no doubt, have endeavored to carry it out had he lived; and that the survivors of the Polaris expedition all indorse it. As to discoveries and researches in other sciences Professor Henry gives the following as some that would and should be made by such expeditions: Pendulum experiments, to better determine the shape of the earth; a greater number and more continued observations for the more perfect elucidation of the magnetism of the earth; a series of observations on the tides for at least a year; and the results of a larger series of observations on the winds of the globe than those now possessed are necessary for completing our knowledge of that subject. Besides these particular observations the Professor thinks that the whole field of natural history could be enriched by collections in the line of botany, mineralogy, geology, etc., and many facts of interest obtained with regard to the influence of extreme cold on animal and vegetable life.

In view of these reasons, and others which our space forbids us to give, the House Committee on Naval Affairs have reported a bill authorizing the formation of a colony on the Howgate plan on or near the shore of Lady Franklin Bay, near where a seam of coal has been discovered. Strong substantial buildings are to be carried there, and the colonists are to be furnished with provisions and other necessaries for three years. The scientists accompanying the expedition, who are to be under the direction of the National Academy of Sciences, are to be provided with all the necessary appliances for scientific discovery, including telephonic lines for maintaining communications between successive stations, and balloons for purposes of observation. It is thought that the colonists will gradually become acclimated, and by training the natives to help them will thus be enabled to push forward into regions hitherto unknown by taking advantage of such favorable seasons as may occur. Whether they will succeed or not remains to be seen. All that we can say is that if the secrets of the far north are to be discovered, this plan seems more feasible than any before brought forward.

WHAT STEAM HAS DONE FOR FRANCE.

According to recent official statistics the total power of all the steam engines existing in France is 1,500,000 horse power, representing the actual labor of 4,500,000 horses or 31,590,000 men. This last aggregate is equal to ten times the present industrial population, which amounts to 8,400,000 souls, but from which must be subtracted old people, women, and children, leaving a remainder of 3,200,000 working men.

It is interesting, says *La Nature*, to compare the above data with the condition of affairs in 1788, before steam engines were introduced in France, as we are thus led to appreciate the enormous revolution which steam and improved machinery have produced. Just ninety years ago in every $200,000,000 worth of French products, sixty per cent of the value represented labor and forty per cent raw material. Today this ration is exactly reversed, although labor has increased forty per cent. At the present time the total industrial productions of France aggregate a value of about $2,400,000,000. Of this $1,400,000,000 represents raw material, and the remainder labor. If the same proportion as existed in 1788 applied now, taking into account the increase in labor noted above, no less than eleven twelfths of the above amount, or $2,200,000,000, would be the cost of handiwork. Roughly, then, steam engines and improved tools have produced an economy of $1,200,000,000; but more than this, if they were suddenly swept out of existence and forgotten, there are not enough men and animals in the country to supply an equivalent amount of power, and even if there were, there would be no way of procuring the necessary food for their support.

IMPROVEMENT OF RIVERS.

A detailed statement of the losses of property on Western waters during the year 1877, owing to obstructions in the various large rivers, shows that it reached the large sum of $5,330,000. On the Mississippi river the greatest loss is sustained between St. Louis and Cairo, at the mouth of the Ohio. Here the river is shallow, and snags are frequently found imbedded in the river, upon which occur wrecks that themselves form further obstructions. The Red river is one upon which the Government has spent much money and labor in order to cut a channel of sufficient width to afford easy navigation; but where the channel was cut through the passage has been obstructed by jams of logs and driftwood. A bill providing for the removal of obstructions from there, as well as from the Missouri and Arkansas rivers, was passed a few days since. The first section of the bill appropriates the sum of $60,000, to be expended under the direction of the War Department, for the removal of snags, etc., from the Mississippi, Missouri, and Arkansas rivers, and for the preservation of Government vessels in that service. The second section appropriates $6,000, to be expended under the direction of the War Department, for the purpose of opening the navigation of the Red river above Shreveport and keeping said navigation open and free from rafts. Bills have since been introduced providing for the improvement of the Osage, Detroit, Galena, and St. Mary's rivers; referred to the Committee on Commerce and ordered printed. On the 5th of December, pursuant to a call from the Governors of Tennessee, Alabama, Kentucky, Mississippi, and Ohio, a convention met at Chattanooga for the purpose of perfecting measures and making an earnest and united appeal to Congress for a sufficient appropriation to secure the completion of the improvement of the Tennessee river, especially at the Mussel Shoals, at as early a date as possible. The committee appointed by this convention has presented a memorial to Congress of very great importance. It sets forth that the Tennessee river is navigable for steamers of from four to five feet draught, the year round, a distance of 330 miles from its mouth to Florence, Alabama; that a section extending a distance of 38 miles above Florence is obstructed by a series of impediments known as Mussel Shoals; that the river is further navigable for steamers of three feet draught from the head of Mussel Shoals to the city of Knoxville, a distance of 389 miles, for nearly nine months annually; that this vast region, although possessing all the latent elements of prosperity, languishes for cheap transportation. It therefore urgently asks for the improvement of the river, especially at Mussel Shoals, as a work of national importance, required as a commercial highway and as a ligament to bind together the States commercially and politically. The memorial was ordered printed and referred to the Committee on Commerce.

PRINTING THE PATENTS.

While we agree with so much of Commissioner Spear's recommendation relative to printing patents which states that it would be desirable in point of cheapness, convenience, and rapidity, if the work of printing could be done in the Patent Office instead of in the Government Printing Office, we do not coincide in the suggestion to increase the final fee by adding thereto the cost of printing the patents. It is proposed to graduate this tax in accordance with the length and complexity of the specification.

Our objection is that under this arrangement the Government would be paid twice for the same extra printing, first by the inventor and second by the public, as the charge to the latter for copies of patents is also to be increased with their length, etc. It would be less objectionable to charge only purchasers of copies of patents the extra price; but this might necessitate a relay of clerks to calculate the various costs. The result would be useless and unprofitable labor. The aim should be to reduce the present charges, not to increase them. The present uniform rate asked for copies of patents has proved satisfactory and remunerative. If any change is to be made in the price, let us lessen it.

THE CARBOLIC ACID OR ANTISEPTIC TREATMENT OF WOUNDS.

Reports are now beginning to come in giving the results of those who have practiced Lester's new system of antiseptic treatment of wounds, and Dr. Robert F. Weir, Surgeon to the New York and Roosevelt Hospitals, has communicated to the New York *Medical Journal* the result of some 56 cases in which Mr. Lester's treatment was adopted.

As American surgeons have been slow to test this mode of treatment, and as many improvements have been suggested by Mr. Lester since its first introduction, we will briefly describe the principles involved and their mode of application. Dr. Weir presents the following synopsis of the theory:

First. That in the dust of the atmosphere, and in matter with which it is in contact, there are the germs of minute organisms, which under favorable circumstances induce putrefaction in fluids and solids capable of that change, in the same manner as the yeast plant occasions the alcoholic fermentation in a saccharine solution.

Second. That putrefaction is not occasioned by the chemical action of oxygen or other gas, but by the fermentative agency of these organisms.

Third. That the vitality or potency of the germs can be destroyed by heat or by various chemical substances, which are called in surgery antiseptics.

Lester himself describes his system as "the dealing with surgical cases in such a way as to prevent the introduction of putrefactive influences into wounds."

The general reader will not demand the whole details of the proper application of this treatment, which are presented with much care by Dr. Weir. The leading points, however, may be interesting:

The antiseptic medium employed is carbolic acid, used in solution of various strengths. The operation is performed while the air surrounding the limb is impregnated with carbolic acid by means of a spraying instrument, working on the same plan as the well known perfumery spray.

Carbolic acid is forced into the wound, and during a surgical operation, such as the amputation of a limb, all the cut and exposed parts, and all textures and substances used for dressings or coverings, are thoroughly treated with the carbolic spray.

The catgut ligatures and silk sutures are also carbolized, and even the hands of the surgeon treated with the spray.

Three solutions of carbolic acid are employed—1 to 40 for the protective layers, 1 to 30 for the spray, and 1 to 20 for a solution in which are immersed the sponges, instruments, and teeth of forceps.

This latter solution is also used to wash the epidermis of the patient adjacent to the wound, the hands and particularly the finger ends of the surgeon.

To work the spray, Mr. Lester has devised a steam spray apparatus, operated by a spirit lamp.

The results that have been obtained from this mode of dressing wounds must necessarily be of absorbing interest to surgeons. Dr. W. H. Van Buren, of this city, in a recent address to the students at Bellevue, stated that he considered it the greatest advance in surgery since the introduction of anæsthetics.

The experience of Dr. Weir comprises about five months of hospital practice, and he considers it the duty of every one having the charge of hospital cases to diligently try it.

In Chambers Street Hospital in 16 cases 8 were failures; an explanation was, however, found for this apparently moderate success, it having been found that from motives of economy the larger pieces of gauze had been washed and recarbolized. This had been poorly done, for when an investigation was made as to why the dressing had failed, the gauze was found to have been imperfectly cleaned and unfit for use.

At the New York and Roosevelt Hospitals the result of 26 cases showed but 6 instances of failure. These cases were chiefly in Dr. Weir's own wards and under his own observation, and he states that even in these 6 cases of failure, retrospection detected some imperfectly followed detail which accounted for the unfavorable condition of the wounds.

THE WASHINGTON NAVAL OBSERVATORY.

Some days ago a petition from Professor Newton and others, of Yale College, was offered, calling the attention of Congress to the present unfortunate location of the Naval Observatory, and asking for such legislation as will authorize its early removal from its present situation to a better and healthier location. Subsequent debate on the bill developed the fact that since the establishment of the Observatory (in about the year 1840) the malarial influences of the Potomac have increased to such an extent as to endanger the health and lives of those who are assigned there for scientific duty. The testimony given on the subject was abundant and conclusive.

This proposition for the removal of the Observatory has since been made the occasion to agitate another and distinct proposition, namely, that its management be transferred from the Navy Department to some other branch of the government, or else that it be made a separate institution under the entire control of a general superintendent. This proposition, which has no legitimate connection with that embraced in the petition before Congress, is a direct attack on the present management of the Observatory, and has called forth a circular from the professors connected with the latter, addressed to the National Academy of Sciences, asking that no member of that body place himself on record as approving of the statements contained in the document of their opponents. Thus the matter at present rests.

The Commissioner of Patents on Models.

Commissioner Spear takes very sound and sensible ground on the model question. He says in substance that the models usually forwarded with applications are unnecessary, that they always add largely to the expense, and are troublesome to keep in the Patent Office. This coincides with our own opinions already expressed. Models are a great tax on the resources of inventors; any examiner ought to be able to obtain as clear ideas as he desires through good drawings and clearly written specifications; and the late fire in the Patent Office has shown that to the dry accumulation of old models might well be applied a stronger term than troublesome. The Commissioner proposes to reserve the right to call for a model where an examiner is in doubt as to practicability of an invention. This is well enough, but there is no need of the Commissioner proposing when he has only to issue the necessary order. The law already says that "the applicant, *if required* by the Commissioner," shall furnish a model, etc. The Commissioner has only to break loose from mere precedent, which is not at all obligatory, establish at once the better regime that he contemplates, and so earn the thanks and commendations of his countrymen.

Restoring the Models.

The result of the attempt to restore the models damaged in the late fire bids fair to more than realize expectation. About 5,000 models have already been restored, and from present indications the whole number capable of being put in good condition will reach at least 5,000 more than the Commissioners estimate, or about 15,000. It is doubtful, however, if the present appropriation will be sufficient for the purpose, as it is believed that it will be exhausted by the time that the restoring of the 10,000 models originally estimated for has been completed.

WHEELBARROWS FOR THE SICK.—The Police Commissioners of Dundee, Scotland, have supplied each police station with a double springed wheelbarrow, for the transportation of drunk and incapable persons. The new vehicles are said to be more convenient and easily managed than any other conveyance that has been tried for the same purpose.

FOR the safe storage or shipment of explosives Herr Gossie, of Antwerp, constructs, either in a railway car or in the earth, a water-tight reservoir, divided by means of T and angle irons into compartments of equal capacity, in which the explosives (suitably packed in water-tight boxes) are placed after the reservoir is filled with water.

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IMPROVED DRAUGHTSMAN'S TABLE.

We can commend to the notice of draughtsmen, artists, architects, and all who do drawing of any description the patent adjustable stand represented in the annexed illustration. We have had several tables of this kind in our office for some time, in constant use by our draughtsmen and artists, and find them to be very convenient and useful. The base is sufficiently solid and made with all the accuracy necessary to insure a firm support. The table portion may be adjusted and clamped to any angle, or turned and fastened in any horizontal direction without moving the lower portion, or raised to any desired height and there secured. The ledge at the rear portion is arranged so as always to

stand horizontal, and forms a convenient place for water cup, etc., while the drawer shown beneath may be used as a receptacle for implements. The table may be turned up vertically to form an easel, so that the entire stand may be stood against a wall or otherwise placed out of the way. Its weight complete is 55 pounds, and the drawing board of black walnut is 44 inches square. In the lowest position the table is 30 inches high, and it may be elevated to 44 inches. Its appearance is tasteful and ornamental, rendering it a piece of furniture suitable for the office, library, or sitting room. Manufactured at the Washburne Machine Shop, connected with the Free Institute of Industrial Science of Worcester, Mass., to the superintendent of which, Mr. M. P. Higgins, inquiries for further information may be addressed.

IMPROVED METHOD FOR DRYING LUMBER.

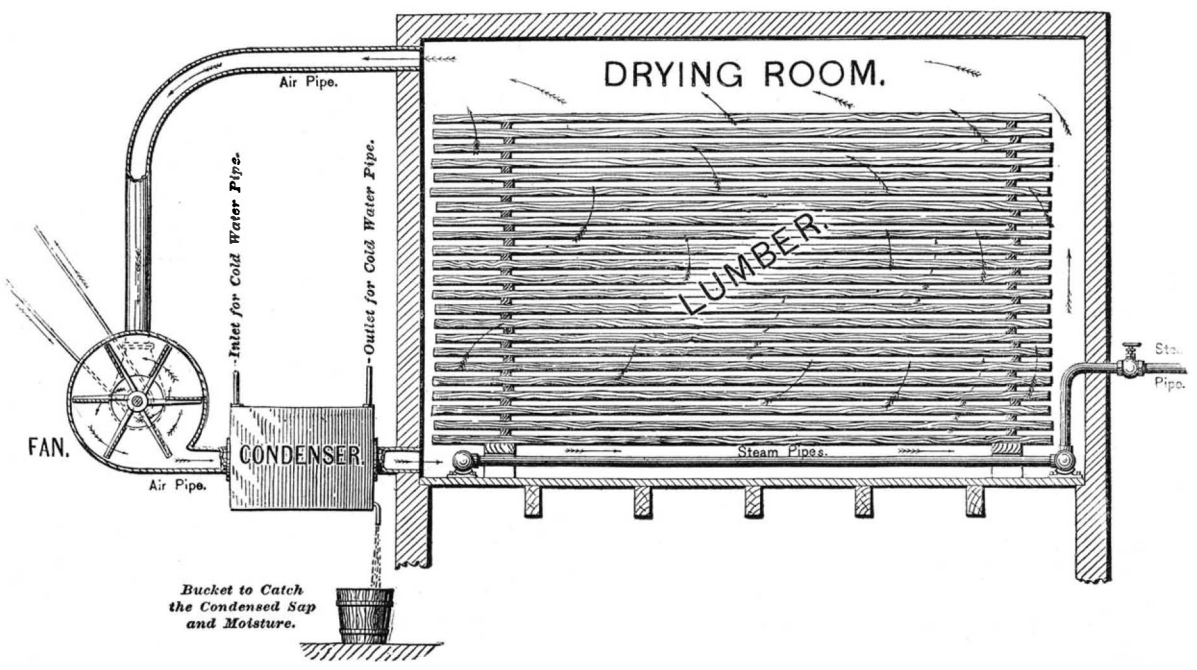
It is a well known fact, laid down in all text books, that drying of air must be done by condensation. The drying of many articles may be done by evaporation and a change of the air, as by a wind, or, if in a building, by ventilation. Wells, in his theory on dew, says that there is a greater deposit on nights when there is a gentle movement of the air, sufficient to bring in contact with the articles fresh air laden with moisture. These facts in the process of drying have been utilized in part by different individuals, but no one has put them together and embodied all of the natural laws until recently, and it is claimed by the inventor of the apparatus herewith represented and described that it has been his special object to construct it on fixed laws and principles with the most simple and efficient mechanical contrivances, and in this we think he has succeeded in an admirable manner.

By reference to the cut it will be seen at a glance that the apparatus is not complicated and can be easily applied, understood, and managed. In a spacious apartment of rectangular form, that can be tightly closed and thoroughly heated, provision is made for piling a number of boards to be dried in such a manner that a space is left between each one. This is effected by laying the boards in parallel rows, one above the other on sticks at right angles with the boards, in a similar way to that seen in all lumber yards, and which is shown in the annexed representation. From the top of one of the ends of this drying room a pipe issues for the purpose of conducting air and vapor from the drying room to a fan attached to a condenser, when condensation takes place and the condensed sap and moisture fall into a receiver, but the air re-enters the drying room. At the bottom of the drying room there are steam pipes, steam being regulated by a globe valve outside. The principal requisites are, therefore, an apartment for the material to be dried that can be tightly closed and thoroughly heated; a fan or blower to draw hot air from the drying room, force it through a condenser, and send it back again; a condenser to extract the moisture from the heated air and discharge it through a waste pipe. The operation is extremely simple, but the results are very important, as will be seen by the appended table compiled quite recently from actual practice. The material to be dried is placed in the drying room, and the door tightly closed. The temperature is then raised to 120° or more, as the case may be, and the blower set in motion. The air is sucked from the room into a condenser, which is kept cool by a stream of cold water. Here its moisture is instantly condensed and discharged through a waste pipe, and it is sent back again, wrung out, as it were, to the drying room. Its relative humidity is changed so gradually, and at the same time so quickly and effectually, that even green lumber can be dried in a few days without warping or checking—an accomplishment that has heretofore been considered wellnigh impossible.

Material.	Weight when put into dry house.	1st day	2d day	3d day	4th day	5th day	Remarks.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1 inch spruce, dry.	35			28	28		Fairly dried in open air
1 " " green.	40½			32	32		
1 " pine, "	61			38	37½		Very green.
2 " " "	164			129⅛	126⅝		Just cut from the log.
1 " " dry.	29	28¾	28½	28	28		Well dried in open air.
2 " maple, "	35	34		33¼	33¼	33¼	Well dried.
1⅝ " " "	8	7½		7¼	7¼	7¼	Well dried.
1 " " "	29	28		27¼	27¼	27¼	Well dried.
5 " pine, green.	12		6				This was round pine
¾ " walnut, dry.	23	22	21½	21	21	21	limbs, 5 in. dia., put in
1 " " "	39	38	37	36½	36	36	directly after cutting.

Leather sides, heavy, have been dried in two hours; vegetable ivory nuts in two days, and other material with equal facility.

The apparatus is patented by Levi K. Fuller, of Brattleboro', Vt., where there is one in operation at the most extensive parlor organ manufactory in this country.



FULLER'S APPARATUS FOR DRYING LUMBER.

Engraving on Glass by Electricity.

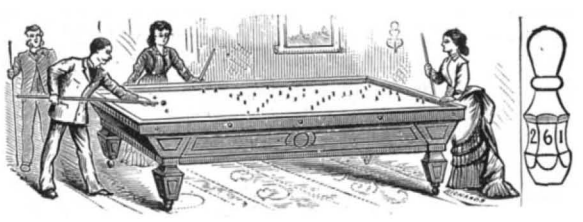
M. Planté, the inventor of secondary batteries by means of which a large quantity of electricity may be accumulated, has just discovered an excellent means of engraving on glass. Having remarked that a glass tube traversed by a platinum wire serving as electrode to a powerful voltaic current was instantaneously spread out in the form of a cone or funnel in the midst of an alkaline solution contained in a voltameter, he made a series of experiments to determine what alkaline solution required the least electric force for devitrification. He therefore thought out the following process, which has given some remarkable results:

The surface of a plate of glass is covered with a concentrated solution of nitrate of potash, by simply pouring the liquid over the plate laid horizontally in a shallow saucer. Then into the liquid which covers the plate of glass is introduced a horizontal platinum wire connected at one end with the edge of the glass plate and at the other with the poles of a secondary battery of 50 or 60 elements. Now taking in the hand the other electrode (formed of a platinum wire surrounded everywhere except at its extremity with an insulating sheath), the surface of the immersed glass is touched with it at the points where it is wished to engrave. Wherever the electrode touches, a luminous furrow is produced; and, whatever be the rapidity with which the writing or drawing is done, the traces made are found clearly engraved on the glass. If the writing or drawing be done slowly, the traces are deeply engraved; as to their width, that depends on the diameter of the wire serving as electrode; if it be sharply pointed the traces may be made of exceeding fineness. Either electrode may be engraved with, but the negative requires a weaker current.

MR. W. SAVILLE KENT is making endeavors to organize a company in London for the purpose of establishing a museum and laboratory at the Island of Jersey, off the coast of France, for the study of marine zoölogy.

THE BON TON GAME.

Our engraving illustrates a new game, adapted for private or public use, called by its inventor the "Bon Ton," and played with a cue, ball, and pins on a table or board suitably made for the purpose; full size 3x10 feet, with rubber cushions. The pins are disposed in various positions, and the game is to strike them with the ball. The difficulty in doing this depends upon the location of the pins. Thus some pins may be so arranged that the ball must pass between pins before the overthrowing of a pin that counts on the game can be effected. Or it may be required that the ball strike one or more cushions before striking a pin in order to count. The inventor sends us diagrams of eighteen ways of placing the pins, by means of which, he states, over sixty different games can be played by using generally from 1 to 10 pins. The number of pins thrown down is counted on the game, or the actual figures on top inscribed on the pins upset are



noted. One of the pins, which is polygonal and has numbered sides, is separately shown in our illustration. Tables are made of different sizes to adapt them to almost any price.

Patented November 13, 1877. For further particulars relative to sale of county and State rights, address the patentee, Mr. John Brown, 105 North Main street, Providence, R. I.

Numeration of Blood Corpuscles.

The numeration of blood corpuscles, a test of the richness or poverty of the blood, has been simplified by a microscopic apparatus constructed by Professor W. R. Gowers. In it tenth of a millimeter squares are ruled on the glass slide at the bottom of the cell. When the corpuscles have subsided to the bottom they are seen lying in the divisions and the number in each can be counted, as in the method of Vierordt. In the French instrument a little fluid had to be placed in the cell to secure the covering glass. To obviate this source of error, in Professor Gowers' apparatus the slide is placed on a metal slip to which two springs are attached; these rest on the edges of the covering glass and keep it in position with a uniform pressure. The dilution employed is 1 in 200. Professor Gowers also adds the hint that it is not well to attempt to observe the character of the corpuscles during the numeration, and that the processes should be kept distinct.

The Swiss Method of Testing Watches.

Mr. Charles H. Upton, United States Consul at Geneva, Switzerland, communicates to the State Department a report on a trial of chronometers which lasted 52 days, from which we take the following data. The chronometers were kept at an observatory, being placed successively, for seven days, in different horizontal and vertical positions, and tested with heat and cold. The trials were classed under three heads, namely:

1. The mean variation of the watch from day to day, which must not exceed ·6 of a second.

2. The mean departure in each of the positions. This must not exceed 2 seconds; and,

3. The error of compensation produced by the change of temperature; the maximum not allowed to exceed ·2 of a second by degree of thermometer. 84 chronometers were entered, 29 of which fulfilled all the conditions. The prize of honor was taken by a Locle manufacturer. The average variation of the winning time piece was ·26 of a second per day; the mean departure in one of the seven positions was ·43 of a second; the error of compensation, ·01 of a second, and the variation of the running after and before the tests of heat and cold ·33 of a second. Such accuracy can only be attained by long trained and consummate skill of eye and hand.

Mulberry Juice a Substitute for Lime Juice.

Dr. Wright and Mr. Patterson, in a paper on "Citric Acid as a constituent of imperfectly ripe Mulberry Juice," which was found to contain 26·83 grains of citric acid and 3·26 grains of potash salts per liter, suggest that the juice may be valuable as a substitute for lime juice, and as an antiscorbutic.

THE production of iron in Russia is placed at 320,000 tons annually.

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VANIER'S IMPROVED BRICK MACHINE.

The new brick machine represented in our engravings belongs to that class in which dry or damp clay is moulded by the application of heavy pressure. Its action is continuous, one pair of moulds being filled while the contents of another pair are being pressed. The construction is as follows:

The pairs of moulds, A, are formed upon the table, B, Fig. 2, and said table is supported by a vertical shaft. The main shaft, C, of the machine carries a heavy fly wheel. Placed above and below the shaft and table are the working beams, D, Fig. 1. The shafts of these beams roll on a flat surface in the ends of the standards, E, and are forced apart by springs. From one beam a tooth projects which is received in a mortise in the other. Above the table is a guide, F, supported by a spider which contains a follower having on its under surface projections which fit the moulds in the table. Means are provided for drawing together this follower, an intermediate block and the upper beam. Connected with the lower beam is another and similar follower. To the rear end of the beams are attached arms which engage with cam lugs on the shaft, C, Fig. 1. Said lugs are arranged diametrically opposite on the shaft and engage the two parts of the toggle simultaneously. The upper cam lug is the wider, so that the motion of the shaft is communicated to the upper beam longer than to the lower one. The toggle arms communicate by means of links with a rocking shaft, and this last communicates with a pivoted lever, G, which carries a roller engaged by a cam on the shaft, H. This shaft is rotated by gearing from the main shaft.

The lever, I, Fig. 2, is pivoted to an arm attached to the rear end of the frame, and is connected with a follower moving on guides formed on the spider. It also has two projections which fit the moulds on the table, and a cam opening which surrounds a disk on shaft, H. J is an endless apron which is moved intermittently. Above the table, B, there is a cylinder, K, in the bottom of which are two openings corresponding to a pair of the moulds in the table; and also several screw blades attached to a rotary vertical shaft.

The operation of the machine is as follows: The clay is placed in the cylinder, K, whence, being agitated and pressed down by the blades, it passes to the moulds. The table is then at rest, and a plate beneath prevents the clay dropping through. While one pair of moulds is being filled another pair containing clay is being pressed by the straightening of the toggle arms on the beams. The greater width of the upper cam on the main shaft causes the upper follower to move the brick downward in the mould after it is pressed, thus loosening it. After the bricks are pressed they are moved forward by the rotation of the table, B, and discharged from the mould by the follower on the lever, I, the table over which the endless belt, J, passes having previously risen to receive them. This table descends simultaneously with the follower, and when the table, B, makes another forward movement the endless apron is rotated sufficiently to carry the bricks outside the framework of the machine, when they may be removed. When the lever, I, is raised by rollers in the periphery of a disk it strikes a pin on the upper beam, causes the latter to rise, and by the interconnection between this beam and the lower one both are thus moved away from the moulds. In the present case the cams act at every fourth revolution of the main shaft, and this intermittent action is secured by holding the toggle cams out of the engagement with the cams while the shaft makes three revolutions, and moving them so that they are caught by the cams at the fourth revolution by means of the connection of the arms with the lever, G, which is moved at the proper instant by the cam on shaft, H. The motion of the fly wheel is accelerated during the three revolutions in which no work is done, and as it is of large diameter and great weight, its momentum is sufficient to exert the required pressure. The inventor states that there is no lateral strain upon the main shaft, as it simply revolves between the toggle arms, and the pressure exerted by the cams is alike above and below. All of the bearings, where any considerable strain is exerted, are constructed with rolling surfaces, so that the friction of the machine is reduced to a minimum.

Patented through the Scientific American Patent Agency November 27, 1877. For further information address the inventor, M. Zéphirin Vanier, Westborough, Worcester county, Mass.

Fig. 1

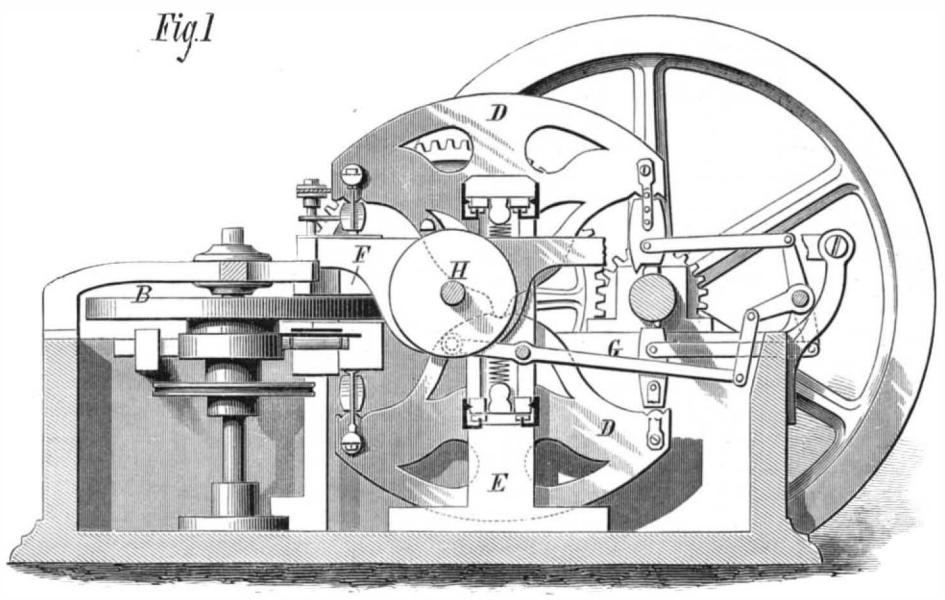
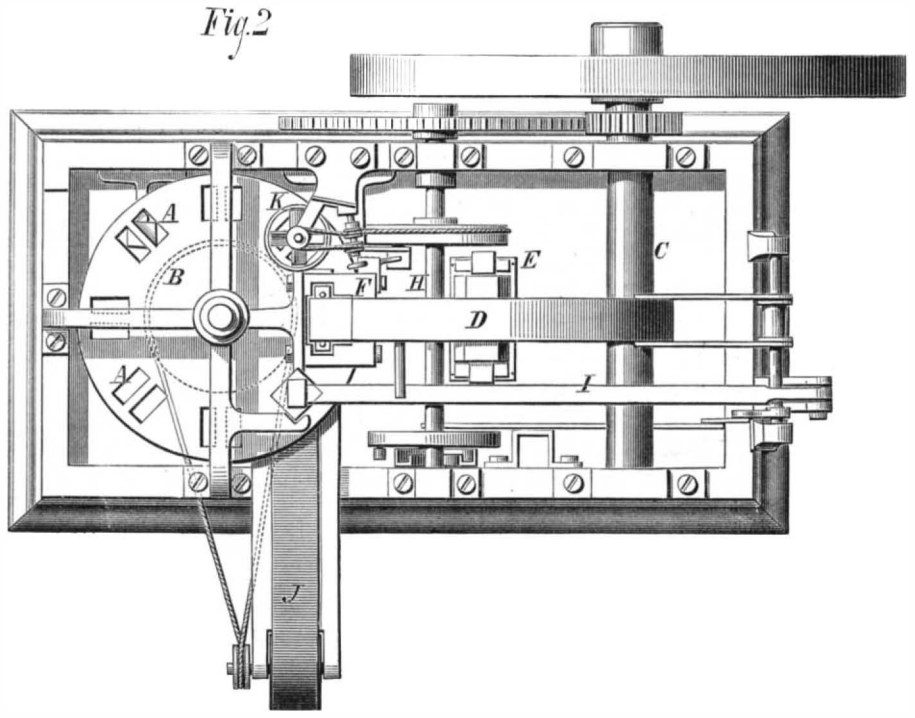


Fig. 2



VANIER'S BRICK MACHINE.

BAUGH'S PATENT SECTIONAL MILL.

In the annexed engravings are presented sectional and perspective views of a new mill in which a sectional system of grinding surfaces is adopted. Such grinding sections as may be broken or worn out may be replaced without renewing all, and various kinds of plates can be inserted to suit any sort of substance to be ground. This change can be very easily and quickly effected. The grinding surfaces are claimed to be arranged so as to be strong and to be subject to the smallest possible wear and tear. Their disposition will be readily understood from Fig. 2.

The No. 1 mill or crusher (Fig. 1) weighs about four tons. A still larger size is made specially for glue manufacturers. The variety of surface "dress" which is attainable under the system of casting in sections is very great, and to each class of substances to be reduced can be applied its appropriate grinding surface. Thus the mills are used not only for hard and brittle substances like minerals, ores, etc., but also for tough raw bones, damp guanos, pork and beef cracklings, and woods.

Each mill is complete in itself, bed plate, countershaft,

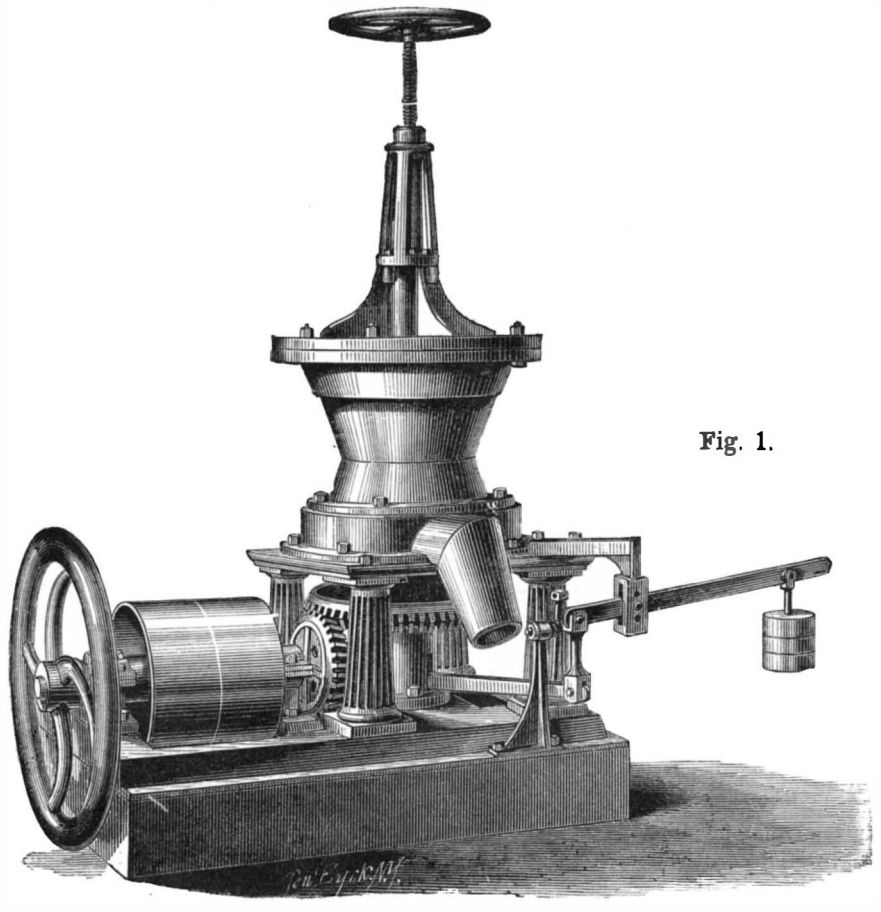
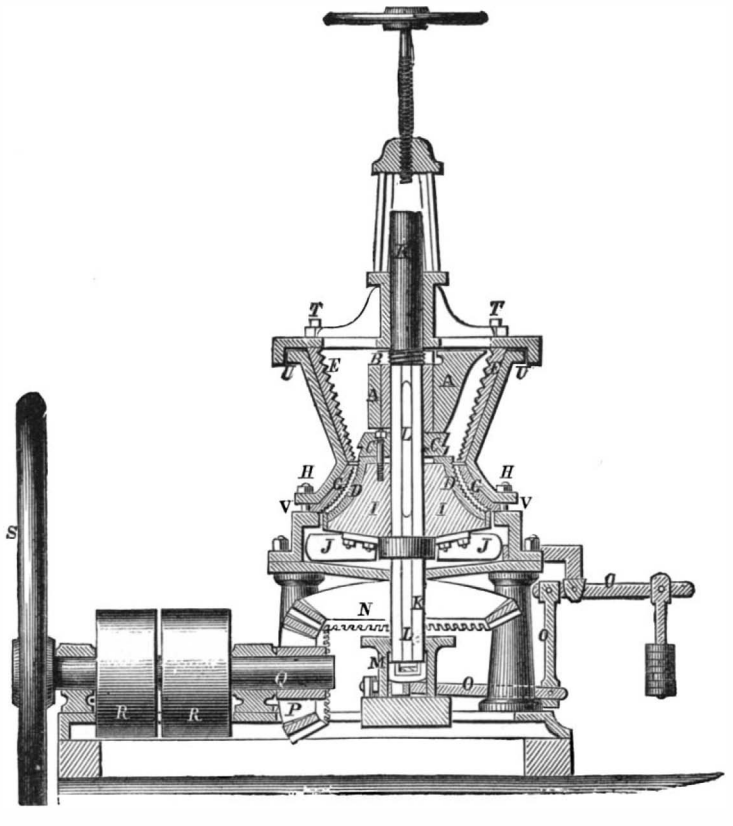


Fig. 1.



BAUGH'S PATENT SECTIONAL MILL.

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fast and loose pulleys, fly wheel, etc., requiring merely to be bolted into position to receive the power to drive them. Suitable means are provided for regulating the fineness of the material to be ground.

For further particulars address Messrs. Baugh & Sons, 20 South Delaware avenue, Philadelphia, Pa.

Communications.

Coal Dust Fuel.

To the Editor of the Scientific American:

Since writing an article for your paper on "Coal Dust as Fuel" I have been in receipt of numerous inquiries as to the *modus operandi*. I think with your correspondent, Mr. C. J. Sanborn, of Massachusetts, that plenty of boiler room, also grate and heating surface, is a prime necessity. Care should be taken to keep all surface exposed to the action of the fire and heated gases as free from soot and ashes as possible. A careful watch should be kept of the inside of the boiler as well as the outside, as with a forced blast it does not answer to allow the scale to fall from the tubes and collect over the fire, as the consequence would be a burned sheet in a very short time. In regard to the grate, I use a flat grate, each bar being about 3 inches wide by 4 feet long, having 2 slots $\frac{1}{8}$ inch wide and 1 inch long to the width of the bar, and about 2 to the foot of the length of bar. I allow $\frac{1}{8}$ inch space between bars for expansion, and 1 inch in length, which I find sufficient. I have 16 square feet grate surface, and use a No. 2 Sturdevant blower, which gives plenty of blast. I do not quite agree with Mr. A. F. Upton, in your issue of February 2, as I have never known the "fine particles of fuel to be blown out of the top of the chimney," neither do I "melt the fuel on the grate," for, if there is plenty of boiler room, there is no necessity of giving it blast enough for that. In regard to the injury to the boiler I fully agree with him, but I think the saving in fuel will doubly cover that loss. I prefer to use the dust free from coal, as my experience is that I can burn fuel much more economically than with it, with less trouble, as the two fuels require different treatment. One peculiarity of dust is that I can run the steam up while cleaning the fire, whereas with coal the tendency is to run it down. Another is that I can keep fire and steam much longer than with coal, frequently keeping it from 4 P.M. Saturday till 6 A.M. Monday, and in several instances till Tuesday, not touching the fire in the meantime, and keeping steam up from 25 to 50 lbs. I use dry live steam to blow out boiler tubes, which (with dust) requires to be done two or three times weekly. There is another point which I have found materially to affect the steaming of my boiler, namely, keep the chamber back of bridge wall deep. I find that with the back from $3\frac{1}{2}$ to $4\frac{1}{2}$ feet deep I do not have to fire nearly as hard to keep up steam; I carry just as thick a fire with the gate in blast pipe half closed as I can, and keep the steam to 60 lbs., then, if an extra quantity of steam is wanted, open wide the blast pipe, thin down the fire, and I have plenty. If I want all that the boiler can make (which I very often do for an hour or two in very cold weather) I carry a thin fire full blast, and rake and stir the fire every few minutes. At night, just previous to shutting down, I rake my fire, cleaning it well, then cover with fresh fuel, only letting it get well warmed up, shut all dampers, and leave for the night. The heat from the walls of furnace will hold the steam about stationary. I usually have from 40 to 60 lbs. the next morning, and in from 5 to 10 minutes after starting the blower as fine a fire as any one would wish. My grate bars have been in two and one half years and are as good as ever, which, as you can see, is a great saving in grate bars alone.

Milford, Conn. WALTER F. SAGE.

Making Wooden Pulleys.

To the Editor of the Scientific American:

A pulley over 24 inches in diameter should be built on a spider; all under that size can be made on a wood centerpiece about 2 inches thick, having a cast iron flange, say 8 inches in diameter, for a 20 inch pulley, with a hub and boss about 3 inches long. Four bolt holes should be made through the flange for bolting to wood center. The latter should be a nice fit on the shaft, with key seat the same as for an iron pulley. After preparing the centerpiece by planing smooth and straight, make a templet, the length being about one sixth or one eighth of the diameter and 2 inches wide. By this mark out the amount of stuff for the required width of face. The lumber should be about seven eighths or 1 inch thick, sawed out to the same circle as centerpiece. Plane straight and smooth, and make the butt joints a perfect fit; glue and nail on. If a flange is desired on each edge to keep the belt from running off, make the outside layer a little wider and allow it to lap over the face. Put the pulley into a lathe and turn it up. Thus made, it will be durable and will not easily break. B. J. DONAWAY.

Terre Haute, Ind.

Preventing Collisions at Sea.

To the Editor of the Scientific American:

In regard to preventing collisions at sea, I would suggest the following plan: Each vessel could carry four different colored lights, say red for north, white for east, green for south, yellow for west; a set of these lights on each side of the vessel. If a vessel was going north it would hoist a red light; if going north-northeast, it would hoist one light under the red; if going northeast, two lights under the red; if east-northeast, three lights under the red; and so with east, south, and west, the white, green, or yellow lights could be raised, and the number of lights under them as the vessel is sailing points to the right of the direction for which the top light stands for. During fogs, when the whistle has to be used, one long blast could mean north; two, east; one short and one long, south; two short and one long, west; and as many short blasts as the vessel is steering points to the right of any of these points.

Eagleville, Ohio. L. A. OSBORN.

The Bicycle vs. Pedestrianism.

To the Editor of the Scientific American:

G. O. A.'s question in regard to the bicycle in "Notes and Queries" I should like to answer in the affirmative. The third time I rode a bicycle on the road I ran twenty miles over a rough road. Several hills were ridden over, and three very steep ones surmounted on foot, and yet my actual running time was two hours and a half. To have walked the same distance would have taken me at least four hours and a half. In regard to the exertion required, I can say that on this occasion, though somewhat tired, I was neither lame nor blistered, *sequelæ* which, I am sure, would have resulted from a walk of twenty miles.

This ride is, of course, a very inferior performance for a bicyclist, but is cited merely to show what can be done by one who was in bad condition for athletic exercise, and by no means an expert rider on his bicycle. X.

A Brilliant Meteor.

To the Editor of the Scientific American:

A meteor was observed by the undersigned last Sunday about 7:53 P.M., more brilliant than Venus, moving slowly from the direction of Andromeda southeasterly, and passing but a few degrees below Mars toward Canopus. The color of the light was white, and its brilliancy for the space of about 30 degrees observed remained uniform, traversing through that arc in about 3 seconds of time. No visible tail remained, though the sky was very clear and dark, but sparks apparently followed the meteor only for about a degree or two. The sparks denoted an apparently spiral movement.

New York. R. D'HEUREUSE.

Influence of Petroleum on the Compass.

To the Editor of the Scientific American:

I find from my own experience, and from information derived from others engaged in the trade, that the compass needle deviates greatly when a ship is loaded with petroleum, either crude or refined. And I have always found the deviation easterly on many voyages, and have never known a case where it was otherwise. The compass in use on my vessel, on my late passage with oil from Philadelphia, was a Ritchie's patent, and the deviation was 11°, or nearly a point. Is it the oil, or is it the immense number of iron hoops on the barrels? We had in 5,592 barrels, with 6 hoops on each. I think it important that it should be known for the guidance of masters inexperienced in the trade that the above are facts. Many ships have been lost, I believe, on this account. JOSEPH HAND,

Master of American bark "Sunbeam," of Philadelphia.

Antwerp, Belgium.

American Passenger Locomotive at Paris.

Among the curiosities to be exhibited at the forthcoming International Exhibition at Paris, says the London *Mining Journal*, is a really marvelous little model of an American passenger locomotive, which runs under steam upon an endless railway of only 6 inch gauge. It was entirely constructed by an American artisan formerly connected with the Delaware, Lackawanna, and Western Railroad Company —Mr. W. R. Lendrum—and is valued at £400. The total length of the engine is 5 feet, and it is a complete representative of the large engine in every respect, the driving wheels being only 7 inches diameter. The pressure of steam used is 22 lbs., and the cylinders, which have a $2\frac{1}{2}$ inch stroke, are but $1\frac{1}{8}$ inch in diameter; the boiler is but 24 inches in length from the smoke stack to the fire pot, and only 5 inches in diameter. Its embellishments are profuse, and include, besides the usual appurtenances, a bell, whistle, sand box, and cab. The model will certainly attract much attention at Paris.

Death of the Leper Governor.

From late Honolulu papers we learn the death of William P. Ragsdale, which occurred in December. Ragsdale, somewhat noted as the Governor of the Leper Settlement on the island of Moloka, Sandwich Islands, was a Hawaiian by birth, the son of a native woman by an American father. He was a lawyer by profession and spoke English and Hawaiian with equal fluency, and was the most noted orator of the whole kingdom. The way in which he discovered that he had the leprosy (*elephantiasis*) was accidental. Sitting in his office at Hilo (the capital of Hawaii) one night, in deep study over a law case in which he was greatly interested, the chimney from his lamp fell on the table. Forgetful of the fact that it was intensely hot, he picked it up thoughtlessly, in his excitement, without feeling the least incovenience. Shocked at this, he looked at his hand, and found that it showed no sign of being burned. Repeating the experiment several times with the same result, he was convinced that he was a victim of the terrible disease, leprosy, so prevalent in tropical countries. His suspicions were confirmed by medical authority, and he lost no time in communicating the fact to the proper government officials. Although it was customary for the police to arrest those suspected of being lepers, Ragsdale on account of his exalted position was not molested. He, therefore, voluntarily delivered himself up as a victim of the fearful disease, and was sent to Moloka, and installed as governor of the Leper Settlement, an office that he held at the time of his death. By his judicious administration of affairs, the many reforms he instituted, and by his kind-heartedness he made himself extremely popular in this sad community of 800 afflicted people, and for these reasons the unfortunates loved him as a father.

The Oroheliograph.

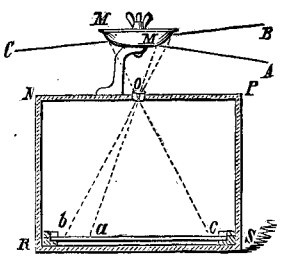
Our French correspondent writes: "Thanks to the extreme kindness of M. le Commandant de la Noë, I am enabled to give his communication to the last meeting of the Photographic Society of France in full."

It is as follows: I have the honor to present a photographic apparatus intended to produce upon one plate and by a single exposure the panorama comprising a nearly complete circle as seen from the position or station necessary from which it is obtained. The only interruption in the image obtained of the whole horizon is that which corresponds to the support of the mirror, which forms the special feature of this instrument; it thus results that if two views be taken, observing that the support occupies a different place in each, a panorama absolutely complete may be secured.

The instrument is composed of an ordinary camera inclined at an angle of 90°, as it was desired to photograph the sky; is surmounted by a parabolic mirror placed at a certain distance above the lens, the focus of which is equal to its axis. The purpose of this mirror is to reflect all the luminous rays emanating from the divers points of the horizon and to concentrate them upon the lens, which they traverse, forming upon the sensitive plate underneath the image of the corresponding points.

With this apparatus is obtained, in the form of a circle, a non-distorted image of the horizon. The horizontal lines become naturally curved, but the vertical lines are not deformed; and the angles obtained from the center of the circle to the different points of the image are exactly equal to those formed by the lines from the station carried out to the corresponding points of the horizon and all visible objects contained thereby. This property makes the apparatus most valuable for reconnaissances, for instance, in mountainous countries; and it can be imagined how by the aid of two or more panoramic views taken from determined places the operator can lay down upon a map the exact positions of different summits and calculate their altitude. In this manner may be obtained, with little labor and expense, the complete canvas or skeleton of a reconnaissance, which may have any of the details completed by ordinary means.

It is for this object, in fact, that the apparatus has been planned, and called by its author "oroheliograph." The problem was drawn up by M. Prudent, captain in the engineers, and realized by Lieut.-Colonel Mangin, of the same corps, who has calculated the form and size of the mirror and studied the various optical conditions which it was necessary to satisfy.



MM, mirror; *b a c*, sensitized plate; O, lens; N P R S, camera.

The model shown to the Society was rather primitive, and was organized to make the first essays. The mirror is not free from imperfections, and there is a sort of astigmatism in the images. The vertical lines are sharper than the horizontal lines. The reflecting surface is badly silvered, and has been injured by want of care in handling; in addition to this the silvering of the exterior is an inconvenience which, by another arrangement will disappear, and will permit of obtaining panoramic views without any interruption in their continuity. For all these reasons the print which has been obtained and exhibited does not possess all the perfection desirable, but it largely suffices to show that the final success is assured. The definite and revised apparatus is now in course of construction, and will most probably be made in such a way as to remedy an imperfection which I have not yet drawn your attention to. On the proof before the Society it will be seen that the landscape is in a sense reversed; that is to say, the objects which in nature follow from right to left are produced on the print from left to right. If it were only artistic results it were desirable to obtain, the film could be transferred upon a pellicle and printed from the reversed side, and the inconvenience would then disappear. But for topographical use this manner of proceeding would have bad results in consequence of the varied contractions of the pellicular image, which would render the angles incorrect; this will necessitate a modification, for which purpose there are several plans to choose from.

Such is the presentation I have had to make. You will, I am sure, excuse my having brought before you an apparatus in so primitive a shape; but I thought that the interest of the question would cover the form. I hope, however, to favor you soon by presenting the complete instrument, and in a state of perfection.—*British Journal of Photography.*

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New Agricultural Inventions.

Mr. Wm. S. Dangler, of Ottawa, Ohio, has patented a Gate Hinge, which is applicable to farm gates that are allowed endwise movement as well as a swinging movement. The improvement consists in a reversible bracket of quadrant shape, which is rigidly secured to the gate post, in combination with a horizontally vibrating guide block bearing an anti-friction roller, on which the gate is suspended and movable.

Mr. Shreve Hartshorne, of Bordentown, N. J., has invented an improved Potato Digger having two sifter plows, concaved to turn the soil inwardly, and set one in advance of the other, together with a large central double-concave sifter plow in the rear. The operation is as follows: The foremost shares are drawn through the earth at a sufficient depth to pass under the hills of potatoes; they loosen and partly elevate the earth, and the rear share raises it still further. As the earth passes over the share it drops between the sifting rods and is separated from the potatoes.

A Fertilizer Distributor, having a shaking shoe under the hopper, operated by a scalloped wheel attached to the land wheel, is the invention of Mr. Wm. M. Boon, of Perry, Ga. It is designed for distributing guano and other fine fertilizers, and may be adjusted to distribute faster or slower, as may be required. The machine is somewhat of wheelbarrow shape, and is operated by hand.

Mr. Isaac A. Benedict, of West Springfield, Pa., has invented an improved Cultivator Plow. On the lower end of the standard is attached the large middle plow, and the draft strain is sustained by braces from the plow beam to the standard. The rear ends of the braces are slotted and the pitch of the central plow is regulated by bolts. The two smaller side plows are so adjusted as to throw the soil inward or outward as desired, and are braced by clamps and rods, the latter being vertically adjusted on the standard.

A Portable Press for Hay, Cotton, Moss, and other material, which has the advantage of baling them at the place of collection, being therefore specially adapted for the wants of farmers, is the invention of Mr. Albert A. Gehrt, of Quincy, Ill. The press is on wheels, and is worked in a horizontal manner by a follower operated by a pitman, eccentric cam, and the tongue which forms the sweep lever. The specification sets forth a number of new details in the operating mechanism.

Mr. Wm. Kinney, of Bellevue, Ohio, has invented an improvement in Clevises, in which the bow has grooves in the inner side of its pin holes and a shoulder formed upon the outer side of its lower end, and in which the pin has a lug upon the side of its lower end and a latch pivoted to and a shoulder formed upon its head. The construction is such that the pin cannot come out accidentally.

Mr. Sam. T. Ferguson, of Minneapolis, Minn., has made some improvements in that form of Sulky Plow in which two independent crank arms are employed to sustain the framework upon the running wheels, which consist, first, in extending the arms of the cranks past each other in parallel position so as to form supports for the platform, one of the crank arms being correspondingly lengthened so as to bring the centers of the wheels into alignment; secondly, in the particnlar construction and arrangement of two tubular sections for forming the crank arms; thirdly, the pivotal arrangement of the plow and its supporting frame, whereby the plow may be turned upside down above the platform for transportation; fourthly, the combination with the lever for lifting the plow of an adjusting device located on said lever for regulating the depth of the plow.

Mr. Matthew Moore, of Whippany, N. J., has invented a Powder Duster for Destroying Insects, applicable also for applying fertilizers. It consists of a rod having a metal shank and standard at its lower end, arranged at such an angle that when the rod is supported in an inclined position by means of a strap passing around the shoulders, the standard is vertical, the devices being combined with a horizontally oscillating receptacle having a perforated bottom, an agitator within, and a lever and connecting rod for imparting motion to the receptacle.

An improved Clevis for attaching the plows of wheeled cultivators to the crank axle has been patented by Messrs. Benjamin F. Needham and Laban W. Needham, of New Castle, Ind. It consists in a pair of slotted clamp plates, arranged to be fastened about a fixed collar upon the axle to form a horizontal bearing, and combined with a pivot bolt for the plow beam arranged at right angles to the axle and carrying adjusting washers to regulate the height of the plow beam upon said pivot bolt, and thus control the depth of the plowing.

Messrs. Wm. V. Devault and Dick J. Devault, of Johnson City, Tenn., patent a Straw Cutter designed to secure a greater sliding motion for the edge of the knife in proportion to the elevation of its lever, and hence a cleaner cut with less expenditure of power. The improvement consists in the construction and arrangement of the hand lever, knife, and gauge bar, so relatively connected as to secure in combination an improved lever action; and in the peculiar arrangement of the mouth of the feed box, designed to increase its capacity and to cöoperate with the knife to produce a better cut.

A Draft Equalizer, or three horse evener, has been invented by Mr. Adolph J. F. Ehrich, of Kellogg, Minn., the object of which is to balance the side draft when three horses are attached to a reaper, plow, roller, etc. This is accomplished by a combination of cross bars and braces with a guide and double pulley, the draft being transmitted from the whiffletree and double tree by chains which run through the pulleys.

Mr. Charles Daniel, of Virginia, Mo., has devised a Reversible Plow, having two plowshares, one left-handed and the other right-handed, attached at the ends of an arm on a shaft which is journaled to the frame. By means of a lever and locking pin either plow may be brought and kept in position for use, or both may be carried horizontally when it is desired to move the plow from one field to another.

New and Simple Photo-Printing Process.

Professor E. Stebbing states that at a recent meeting of the French Photographic Society, Paris, which he reports in a letter to the *Philadelphia Photographer*, the most interesting and instructive communication of the evening was upon a new photographic process by M. Gobert, of the Bank of France.

This gentleman gave a rapid history of the value of the lithographic stone, of the difficulties to obtain it, and its probable disappearance ere long from the market, if new quarries could not be found. Under these circumstances anything which could replace it would be a great boon to commerce; "that is why," said he, "I have been studying to replace it by plate glass, of which we have no fear of having a scarcity, and I have succeeded beyond my expectations; the only novelty being in the employment of ground glass. As to the photographic and lithographic manipulations, they are well known, and I have not changed them."

M. Gobert takes a ground glass, made rough either by an acid or by any mechanical means. On the finely ground surface he pours the following mixture: Albumen, 100 ozs.; bichromate of potash, 3 ozs.; the plate being held all the time by an India-rubber holder. When covered, the plate is turned upside down, and hooked upon a piece of string hanging from the ceiling by means of an iron eye screwed into the handle of the plate holder; the plate is now made to turn rapidly, in order that the centrifugal force may bring the solution on the surface as even and as thin as possible.

It is necessary to have the prepared surface as thin as possible. When dry, it is put into the screw press or printing frame, under the object to be reproduced; if placed in the sun an exposure of one or two seconds suffices; if in the shade, naturally more is required.

When exposed the plate is taken into the dark room, and without any preliminary operation it is inked over with ordinary printing ink; the ink sticks to every part and makes it look like a blackboard. The glass is then plunged into a tray containing water, when immediately the ink breaks up like, as it were, a sea of ice, from all the parts on which the light had no action, and leaves the image standing out in bold relief. All that is necessary now is to send it to an ordinary lithographer to have as many prints as may be required. From 200 to 1,000 may be printed off the same plate. Professor Stebbing is certain that this idea will be very fruitful, and adds that although only line engraving can as yet be obtained, who knows but what ere long the half tones may be produced with ease? As to sharpness and fineness of execution in the reproduction of some bank notes which were handed round at the meeting, nothing could be desired; they were admirable in finish and execution.

Imitations of Tortoise-Shell and Mother-of-Pearl.

The current number of the *Gewerbe Zeitung* says that imitations of lapis lazuli, tortoise-shell, and mother-of-pearl are imported from Paris and highly extolled, while the same process of manufacture was known and practiced in East Austria as long as twelve years ago by the now deceased chemist, Leo Fichtner, of the firm of Fichtner & Sons, at Atzgersdorf, near Vienna. Illustrating its remarks with two beautiful samples, one of the factitious tortoise-shell and the other of the mother-of-pearl, both of East Austrian production, it proceeds to tell how they are made.

The "shell" imitation, which is in the greatest demand, may be made on glass, and consists of a layer of clear gelatine on which the characteristic markings of the tortoise-shell are produced by dotting it with a concentrated solution of vesuvin (aniline color), to which a handsome reddish shade may be given with fuchsin; or the solution is spattered over the surface and the drops allowed to run together. When dry the whole is covered over with a coating of glue.

The imitation of mother-of-pearl is more difficult. It may likewise be made on glass, and contains in the first gelatine layer a concentrated solution of some salt. Several salts may be chosen for this purpose, such as white vitriol, epsom salts, etc. After the crystallization of this salt solution, and when dry, essence of pearls is spread over the whole. The latter material (which is also used in producing most deceptive imitations of pearls) is made from the exceedingly fine and silvery shining belly scales of the white fish, which are scraped off and washed out thoroughly.

To the gelatine layer thus prepared a coat of glue is applied and the article is finished.

Harmless Colors.

It is a well known fact (and the London *Lancet* has recently called attention to it again) that at the present time it is almost impossible to find among the painted toys for children a single one that does not contain, in the colors used for its decoration, substances that are either positively poisonous or else injurious to the health. It seems probable that this important matter is soon to be remedied by the substitution, for the pigments now in use, of a series of perfectly harmless colors which the experiments of M. Turpin have succeeded in producing. At a recent meeting of the "Society for the Encouragement of National Industry," in Paris, M. Turpin exhibited a series of samples showing every shade of every color necessary to fill out the entire chromatic scale of Chevreul.

Among these colors the principal ones are derived from eosine or from fluorescine. They furnish, with hydrated oxide of zinc, lakes of very rich shades, varying from pale rose to dark red (of a vermilion tint). The lakes derived from chromate of zinc and a potassic solution of eosine are remarkable for the brilliancy of their tints, which may vary from pale yellow to the brightest orange-red. Fluorescine treated in the same manner yields lakes of a beautiful yellow, and by making use of a proper admixture of these two bodies there may be produced very brilliant lakes, which are incomparably more beautiful than the poisonous colors now in use, such as vermilion, red lead, orange mineral, and chrome yellow.

These new colors may be used either in oil, varnish, or water, and the majority of them can even be made into a paste with caoutchouc, since they resist the temperature at which the last is prepared.

New Mechanical Inventions.

A new Roller Skate, in which the curves may be rounded with facility by the centrally pivoted roller shafts and hangers of the sole and heel plate, is the invention of Mr. Silas A. Allen, of New York city. The improvement consists in having a combined sole and heel plate with solid triangular bottom pieces, which are recessed to form arc-shaped cheeks, along which the roller shafts, pivoted to the center of the reversed pieces, swing, to admit by the rocking of the sole and heel plate the converging of the roller shafts and the rounding of curves.

A Machine for Testing the Quality of Rolling Stock, etc., such as rails, wheels, axles, journals, brasses, springs, and other parts, is the invention of a Hungarian, Szent-Gyorgyi Elek, of Buda-Pesth, Austro-Hungary. The object is to provide a machine for testing at any place the materials, subjected to the same mechanical wear as when in use, and not under the fixed conditions of the ordinary testing apparatus. The machine is called by the inventor a "rotary railway-rail." It has endless rails placed on supporting disks of a revolving axle, upon which the wheels, with their axles, boxes, and other appurtenances, are weighted down as desired. In this manner the inventor claims a means of ascertaining whether materials are furnished according to contract, of deciding between different forms of construction, of testing lubricators, of observing the causes of heating of bearings, and of determining the manner of avoiding the latter.

Mr. Thomas Fetherstone, of Orange, N. J., has invented a Propelling Device for boats, in which a screw propeller is operated by a revolving double crank shaft, worked by the feet, which carries a large bevel wheel transmitting motion to the propeller shaft by an intermeshing bevel pinion at the end of the latter. By means of hand levers, extending forward, additional power may be added by persons in the boat. Mr. Fetherstone makes the propeller shaft flexibly jointed, to provide for the giving of the shaft to unequal strain, and to admit of adjusting the screw at varying depths under water.

Mr. William H. Sutton, of Purdy, Tenn., has invented an improved Nut Lock for the nuts of fish-plate bolts, to prevent them from working loose. It is formed of two strips of sheet metal slitted longitudinally and transversely, having the flaps thus formed bent outward at right angles to make flanges which rest against the sides of the nuts, having hook-tongues at the outer ends to hook upon the ends of the fish-plate, and having a tongue formed upon the inner end of one strip to hook into the inner end of the slot in the other strip.

An improvement in Half-Springs for vehicles has been patented by Mr. Lewis J. Bazzoni, of Newburg, N. Y. The object is to connect the side bars or body sills of wagons with the ends of the half-springs in such a way as to give motion lengthwise and sidewise, so as to prevent twisting and straining. The new feature is the employment of short plate springs, secured at the upper end in a socket of the side or cross bar, and pivoted at the lower end to a lug bolt in the half-spring.

An ingenious Platform Door for Stove Ovens, which is weighted at its lower end and provided with inclined pivots working in ears on the frame, so as to close automatically and remain closed without a latch, has recently been patented by Mr. Ebenezer Barrows, of Brooklyn, N. Y.

Mr. E. A. F. Toepperwein, of Boerne, Tex., has invented an adjustable Gun Hammer, carrying a swiveling striker, with locking devices, so arranged that the same hammer may be used with both barrels of a double gun; the striker being capable of such adjustment as to bring it within the range of either nipple, or into an intermediate position between the two, for the prevention of accidents. The hammer may be used also with a single gun, or with one having more than two barrels.

Messrs. A. J. McCollum and Thomas Seely, of Marion, Ind., have invented a Saw Mill Carriage Attachment, by which logs, after being quartered, can be cut up for barrel heads and staves the full length of the logs, the boards being then cut with butting-saws into pieces of the proper length.

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PROFESSOR S. N. CARVALHO'S NEW SYSTEM OF SUPERHEATING STEAM.

The fact that we are this day discharging into the atmosphere through the chimneys of steam boilers, either from imperfect combustion or defective methods of absorption, and transfer to the water, from 20 to 50 per cent of the calorific value of the fuel (and in exceptional cases, where a forced blast is resorted to for the purpose of gaining large capacity from a comparatively small boiler, as high as 70 per cent of the actual heat value of the fuel), is almost a reproach upon the engineering intelligence of the age.

The inventor of this new superheating system claims that it, if applied to these boilers (which he says can be done at a small cost), will remedy this great waste by recovering fully 25 per cent of the actual product of the coal and converting it into useful heat in the boiler and increased energy and power in the cylinder of the engine.

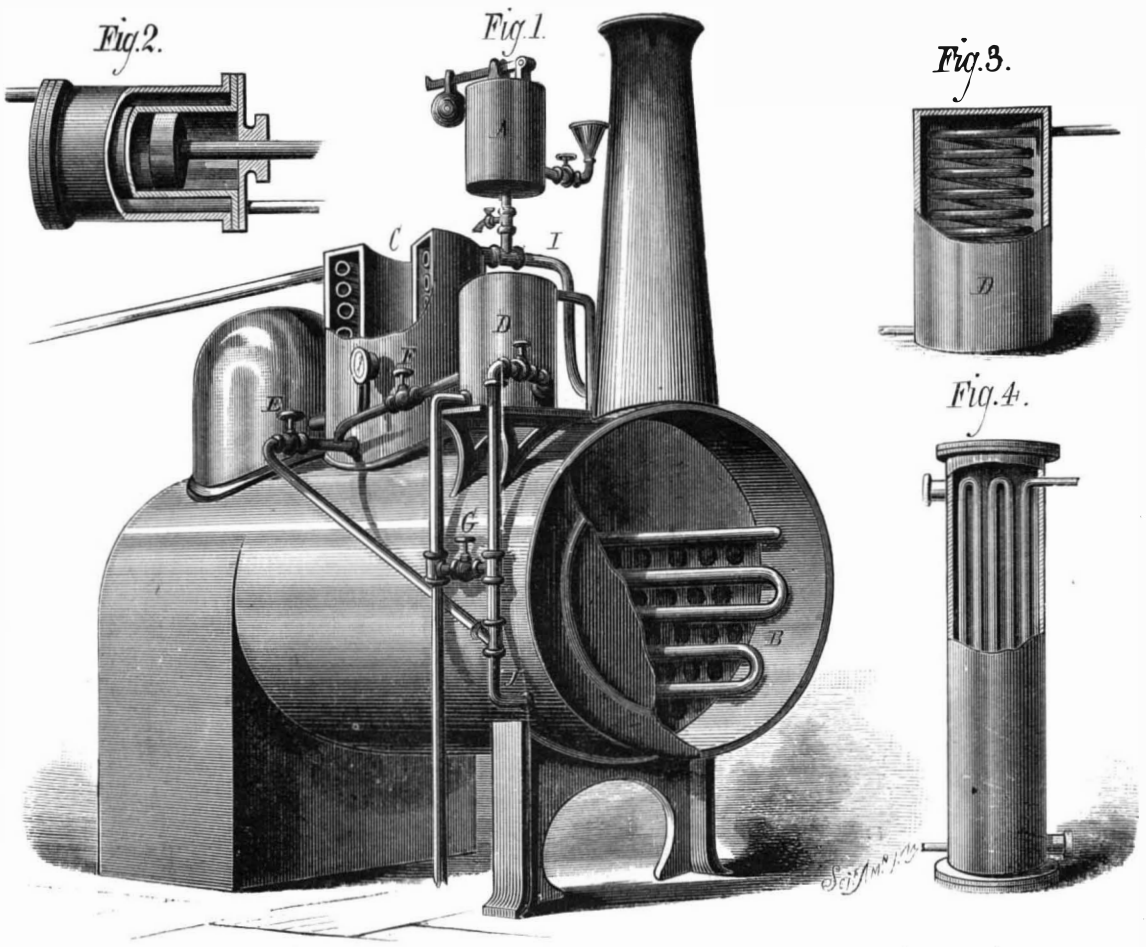
This heat is employed to superheat the steam and subsequently to raise the temperature of the feed water. In the majority of boilers the inventor finds the temperature of the escaping gases high enough for his purpose, but in some cases he places absorbing pipes in a hotter portion of the gas passages, with, he claims, economic effect, even if heat is appropriated which would otherwise be transferred in evaporating steam directly in the boiler. The inventor depends upon the principle that, if steam entering the cylinder can be supplied with heat additional to that required for its existence as true dry saturated steam, just sufficient to furnish the heat units transmitted into work, and to compensate for the heat which would be abstracted by contact with the cylinder from saturated steam, and if this addition of heat can be rendered capable of control, so as to leave the steam exhausted at the end of the stroke at saturation for the temperature and pressure obtaining at the opening of the exhaust, the best and most economical conditions of its use in the cylinder would be accomplished. The two greatest obstacles to the attainment of these conditions have been the perishability of superheating apparatus and the difficulty of controlling the exact amount of superheat given the steam.

The use of the apparatus is not confined, we are informed, to the drying and superheating of steam on its way from boiler to engine, but the main circuit of pipes connected with the feed water tank and absorbing surfaces in the hot region communicates with a hot water jacket around the cylinder, and the circulation of water in this, the inventor asserts, evaporates any entrained water and superheats the steam directly in the cylinder, the action being regulated by suitable devices. The invention is also claimed to be adapted to many other industrial purposes, as the boiling of soap and sugar, baking of bread, biscuit, etc.

Referring to our engraving, A is a reservoir with safety valve and funnel, and at B are the absorption pipes in the back connection; C is a superheating coil in an annular drum, and there is another coil in the feed water tank, D. A valve, E, is provided on the coil from the superheater, C, and valves, F, are arranged on the exit pipe from the feed water tank. When valve E is open valves F are closed, and the feed water tank is thus shut off from the system. G is a valve connecting with the feed pump for filling under pressure. A funnel is provided, as shown, for filling by hand. I is the feed pipe entering tank, D, and J the pipe from tank to boiler. Fig. 2 shows the hot water jacket around the cylinder of the engine in connection with the absorption pipes and feed water tank. Steam is thus superheated in the cylinder instead of in C. Fig. 3 shows a coil of pipe inclosed in a metallic oven to take the place of feed water tank, D. The surplus heat in pipes of superheater, C, is regulated by its radiation to contents of the oven. Fig. 4 represents a plain wrought iron cylinder or pipe with coil of tubing, to take the place of the double cylinder, C. The latter is intended to be placed around the smoke stack of a marine or locomotive boiler.

Among the other advantages claimed are that at no point of the entire apparatus is there a square inch of surface exposed to the heated gases which does not have water on the other side. This the inventor considers brings the superheating surfaces under precisely the same conditions as the ordinary water heating surfaces of a boiler, and renders them in nowise less durable. The apparatus was used at the last fair of the American Institute in connection with the boilers that supplied steam to the machinery exhibited, and received commendatory testimonials and a medal. The inventor also submits a report of calorimeter tests, which credits a pound of steam superheated by his apparatus with an average mean of 65 units of heat more than is stated to exist in a pound of ordinary steam.

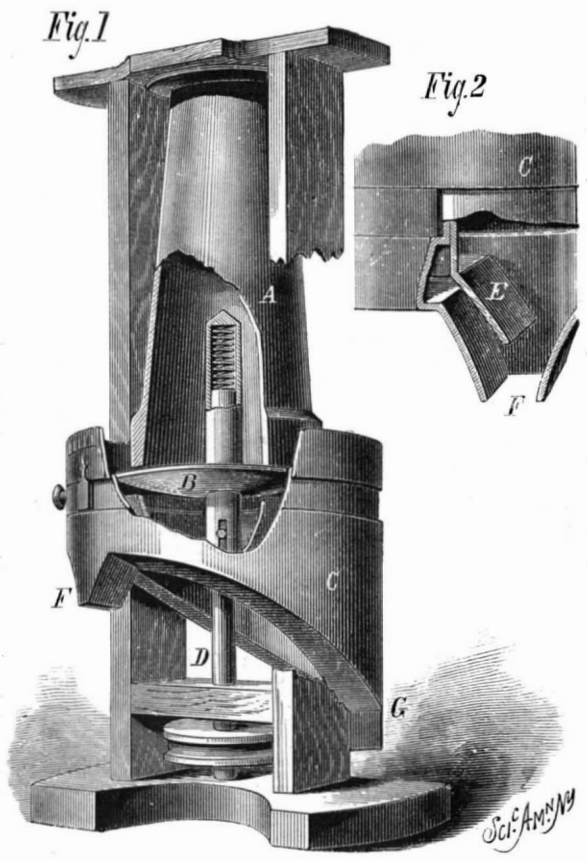
For further particulars address Professor S. N. Carvalho, 65 East 127th St., or 119 Liberty St., New York city.



CARVALHO'S FEED WATER HEATER AND SUPERHEATER.

VITT'S IMPROVED GRAIN TOLLER.

We illustrate herewith an improved mechanical grain



VITT'S GRAIN TOLLER.

toller, designed for use in custom mills for the purpose of taking the toll accurately and without trouble to the miller. It may be readily adjusted to any proportion of toll as may be agreed upon.

A is a conducting tube, through which the grain passes down upon the slightly concaved revolving disk, B. The latter is lowered by the pressure, and the grain gradually escapes between the lower end of the tube and said disk, and enters the annular casing or receptacle, C. The tube, A, Fig. 1, is slightly increased in diameter toward the lower end, so as to let the grain pass down with less friction on the sides of the tube, and consequently to enable it to exert more pressure on the disk. The latter has a central tubular portion, which is connected by a coupling pin to the shaft, D, which is rotated. The upper part of the tube is closed and a spiral spring is provided therein, so that the disk may freely play up and down while revolving. The disk adjusts itself to the pressure of the grain and automatically regulates the opening and outlet, according to the quantity of grain coming in at the top of the machine. The spring, by yielding, allows the disk to work as well with an irregular as with a regular flow.

The casing, C, is arranged with two vertical partitions, one of which, E, Fig. 2, is movable, and is adjusted by a set screw, face plate, and index along the graduated scale on the exterior of the casing. The partitions, when adjusted to the proper distance, take up a certain fixed proportion of the circumference of the disk, and receive, by the uniform dropping of the grain over the edge of the disk, a corresponding proportion of the grain passing down the tube, A. This forms the toll agreed upon between the miller and customer, and it is conducted through an exit spout, F, to a suitable receptacle. The main portion of the grain passes along the spirally inclined bottom to a second exit spout, G.

Patented through the Scientific American Patent Agency December 11, 1877. For further information relative to sale of entire patent, address the inventor, Mr. Adolphus H. Vitt, Union, Franklin Co., Mo.

Armor-Plated Fish.

The new number of the *Popular Science Review* (London) contains an illustrated article on "Armor-plated Fish," by Mr. Henry Woodward. This is an interesting article, and should be read in conjunction with two papers by Professor Burt Wilder on the Lepidosteus or gar pike, in the *Popular Science Monthly* of last year.

The extraordinary structure of the Ganoidea offers an attractive field for study, and additional interest is added by the fact that few species of this order at present exist. They remind us of a past age, for their fossil remains occur in abundance in almost all the fossiliferous strata of the earth, and in some of the older formations constitute almost the only indications of the existence of vertebrated animals upon our planet at the period of the deposition of these strata.

The most interesting specimen of this order, the Lepidosteus, is found only in the waters of the United States, and can be seen alive at the Aquarium in our city; these appear to possess an adamantine vitality, and have outlived all other fish in the establishment.

Are Natives of India Color Blind?

A correspondent of the *Times of India* calls attention to the remarkable confirmation to be found in the perceptive powers of the lower caste natives of the theory started by Mr. Gladstone in his recent article on the "Color Sense of Homer." "Our natives," he writes, "cannot distinguish between blue and green. They apply the word *lal* to a variety of objects we should describe as yellow and brown, and apply the generic epithet 'tambada,' corresponding to Homer's *Chalkos*, to all the bright red tints. Like Homer they speak of the blue sea as black (*Kala pani*). They apply the word *nila*, dark blue, to a gray horse, and their notion of the color of the sky, or *Asmani rung*, is a light gray. The subject can be readily tested by anyone by telling his 'boy' or some less civilized native to choose a blue, red or green book from a pile on the table. I have just tried a puttawallah with different colored books. Between green and blue he cannot properly distinguish; *tambada* he applies to vermilion, and the rainbow he protests is simply red or green. This is just what Mr. Gladstone says about the color sense in Homer's Greeks."

The subject (says our contemporary) is one of great interest, but we think our correspondent has been a little rapid in his conclusions. We have tried several puttawallahs in the way he suggests, and with colors on a palette. But they distinguished readily between colors and even shades of color. The glowing and many colored fabrics for which India is famous certainly suggest that a portion of the population at all events have been educated through generations of inherited experience to a very keen sense of color indeed. With whole sections of low caste people it may of course be different. The theory is novel, and perhaps worth the attention of scientific men in India.—*Madras Times.*

THE forging and tempering of iron or steel can be greatly enhanced, according to Herr Edward Blass, by dipping the metal in fused salt. This dipping in salt is also well adapted for annealing steel without the oxidation of the surface.

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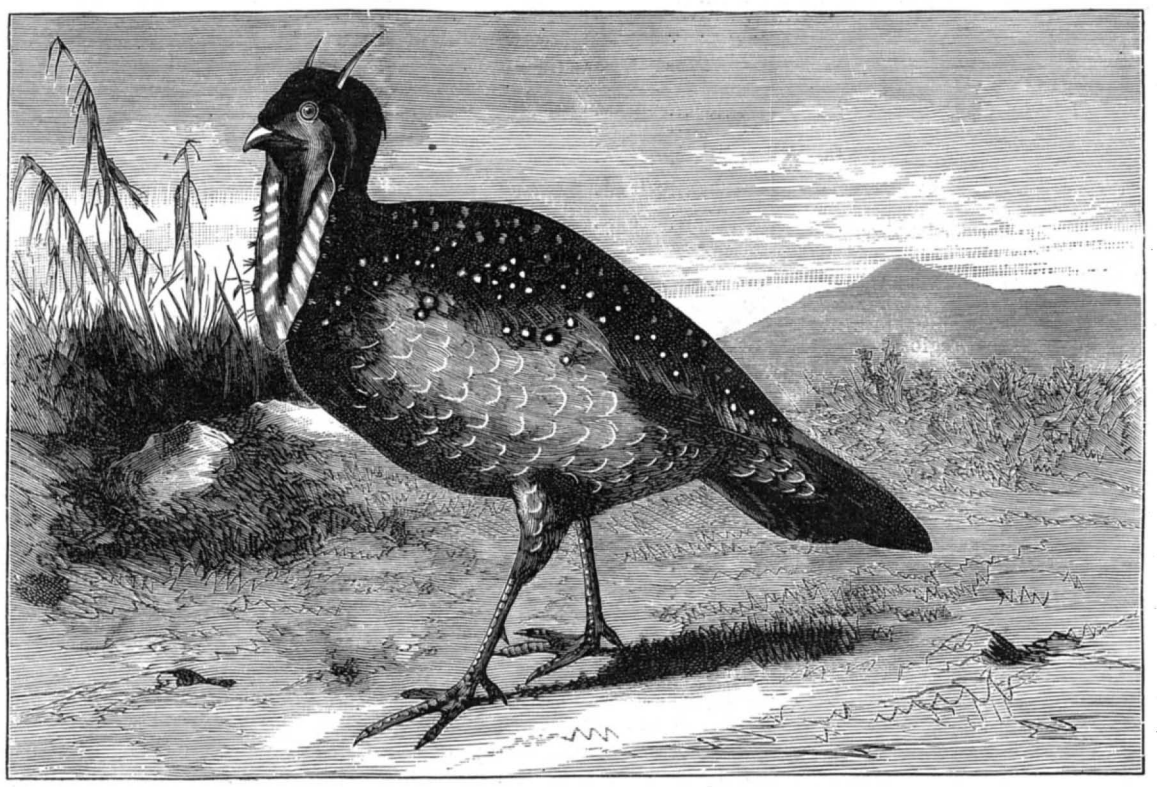
THE HORNED TRAGOPAN.

The horned tragopan is one of the most curious of Chinese pheasants, and is found in the higher and more mountainous districts of Thibet and the Himalayas. Its colors are of the most brilliant description and are of shades which are not usually found among birds; the delicacy and marking of the feathers are very pleasing to the eye. The males, at the time of mating, have bluish horns on the sides of the head and a band of bright colors on the forepart of the breast. The bare skin about the eyes and the wattles are bluish purple, and the feathers of the crest, together with the chin and back of the neck, are deep black. The upper part of the breast, the neck and shoulders are light cinnamon, with a dash of carmine and purple, and variegated by the white eye-like tips of the feathers. The wings and part of the back are rich amber mottled with brown, and decorated with pearlish-gray spots. The tail coverts are also amber-brown, spotted with white, and extend to such a length as nearly to conceal the short rounded tail. The males are also remarkable for the loose pendent skin which hangs from the base of the lower mandibles and can be inflated at the pleasure of the bird. The horns hang listlessly down the cheeks and can be elevated at will. It conceals itself in the most thickly wooded regions, where the Chinese actively hunt it. They call the horned tragopan by the expressive names of ko-ky, kiad-ky (horned chicken), and of ling-tsiou-ky (starred chicken).



THE HORNED TRAGOPAN.

A TURKISH IRONCLAD.

The Payki Shereef is the name of an ironclad corvette with twin propellers, which was built for the Sultan's Government in England before the obligations of neutrality in the present war forbade English shipbuilders to supply additions to the Ottoman naval forces.

The accompanying illustration is taken from the London *Illustrated News*. The dimensions of this vessel are: Length, 245 feet; beam, 52 feet; depth, 22 feet; displacement, 4,700 tons. She has a central battery, in which she carries four 25-ton Armstrong guns, so arranged as to command an all-round fire, and when firing broadside to concentrate their fire within sixty yards of the vessel's side. The thickness of armor is 12 inches amidships, diminished, as usual, toward the ends, and extending from 5 feet below the water line to the main deck, which is entirely covered with armor 3 inches thick over engines and boilers, and 2 inches thick beyond. The side armor also reaches to the top of the central battery, which it entirely encircles.

One important feature in the ship is her extreme handiness and quickness in answering the helm. In testing this quality the vessel was found to make the entire circle in a diameter of 420 yards, with engines going full speed, in 3 minutes 30 seconds.

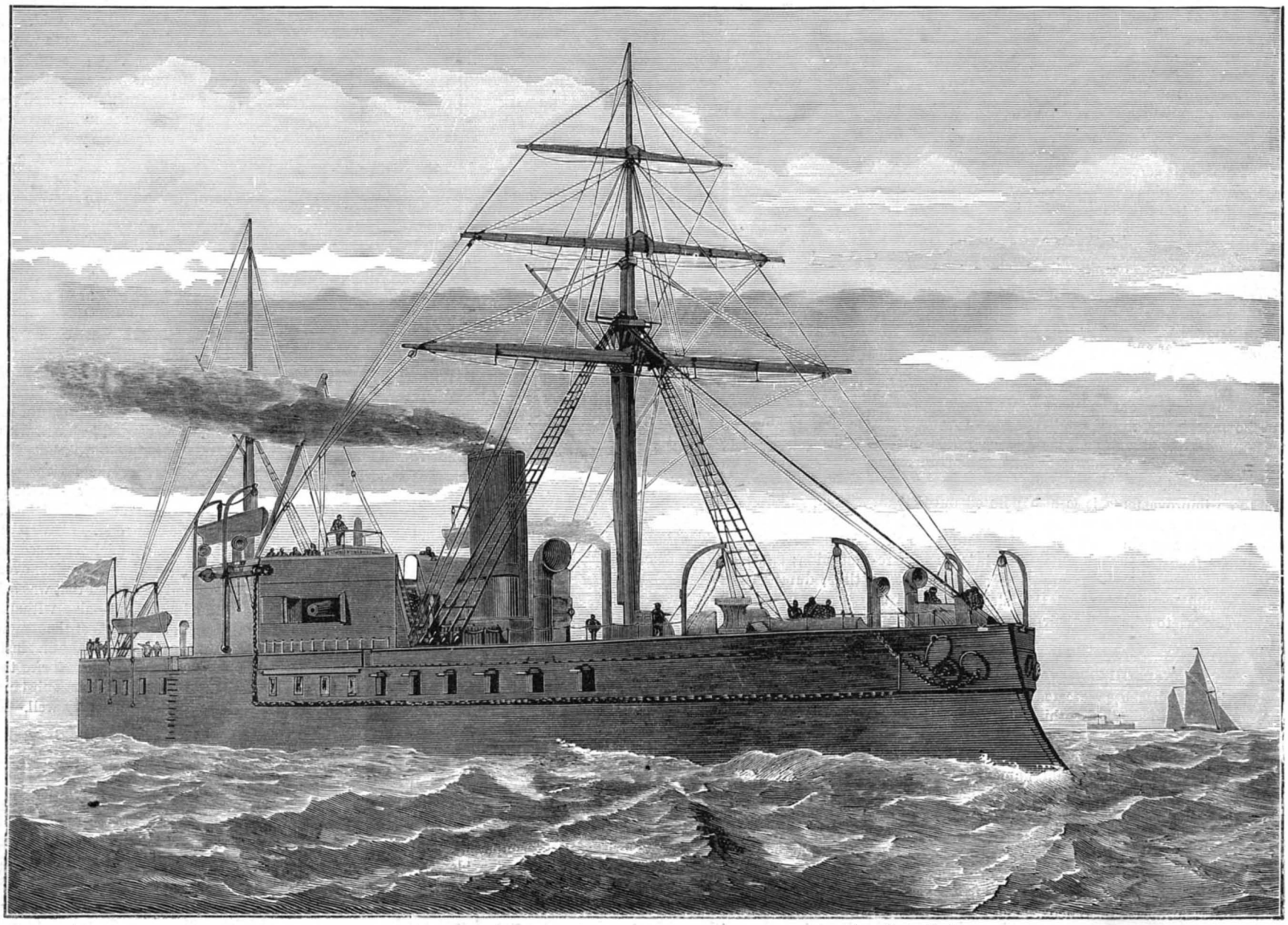
THE number of applications for patents in England, last year, was 5,069, the largest yet recorded.

Toughened Glass.

Some experiments were lately conducted by Messrs. Bennett, Royle, Hickson, and Holden, of the Manchester Society of Architects, England, on the strength of thick glass of ordinary manufacture, and also after having been toughened by the Toughened Glass Company's process. A sample of ordinary rough plate glass half an inch thick was first subjected to a test of its transverse strength. A piece, 8 inches by 4¼ inches, was laid upon supports 6½ inches apart, and was broken at the first trial by a lead ball, 1½ lb. weight, falling on its center from a height of 2 feet. A piece exactly the same size, which had been toughened, was then tried under similar circumstances. The lead ball, 1½ lb. weight, was dropped upon the center of this plate from a height of 3 feet without effect, and afterward from increased heights up to 8 feet, also without effect.

The weight was then increased to 3 lbs. 10 ozs. which was dropped on the center of the plate from a height of 2 feet without effect, and afterward from increased heights up to 10 feet 9 inches, when the piece broke up. Nine trials were made on the piece with the 1½ lb. weight, and 18 trials with the 3 lbs. 10 ozs. weight, or 27 in all. The next experiment was on ordinary rough plate glass, 1 inch thick. A piece 8 inches by 4¼ inches was laid upon supports 6½ inches apart, and was broken at the first trial with a lead ball of 3 lbs. 10 ozs. weight falling on its center from a height of 2 feet. A piece of the same dimensions, which had been toughened, was then tried without alteration of circumstances. The lead ball of 3 lbs. 10 ozs. was dropped upon the center of this plate from a height of 2 feet without effect, and afterward from an increased height up to 20 feet without effect.

IN Queensland (Australia) 300 miles of railway, with a gauge of three feet six inches, have been opened to traffic. The weight of the rails is forty pounds to the yard.



THE NEW TURKISH IRONCLAD PAYKI SHEREEF.

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SADLIER'S NEW METHOD OF RAISING AND LOWERING SCREW PROPELLERS.

Captain J. W. Sadlier, of the State Line steamship "State of Indiana," has recently invented a new mode of raising and lowering propellers while the same are on the shaft, the object being to adjust the screw to such a depth as may, under different circumstances, be necessary to prevent its being affected by the pitching or draught of the ship. The racing of the screw during stormy weather, or when the vessel is lightly loaded, is one of the inherent evils of screw propulsion, and one to the remedying of which more attention might profitably be bestowed. It can readily be apprehended that the alternate lifting and immersion of the screw while in motion throw sudden strains, often of severe character, upon the engine, while racking the vessel herself; and that constant care and watchfulness are necessary to prevent injury to the machinery. Captain Sadlier's invention affords a means of placing the screw at any depth desired, and instead of having a rudder post supported only from above and located in rear of the screw, as otherwise would be necessary, he abolishes rudder post altogether, and hinges two rudders, B, one on each side of the dead-wood just forward of the stern post. It may be said, however, that, according to this plan, there is really no dead-wood, as all that region abaft the bulkhead, A, is occupied by an iron frame, through openings in the keel extension of which the water is free to enter and emerge at the after side apertures, as indicated by the arrows in the vertical sectional and plan views herewith given. Water pressure on both sides of the rudders is thus balanced. The rudder posts extend up to the spar deck, where they terminate in cog wheels, C, by means of which motion is imparted to them by the simple positive steering gear shown in Fig. 3. The rear portion of the screw shaft passes through a ball-and-socket water-tight joint in bulkhead, A, and is attached to the main shaft by a universal joint.

There are two iron stern posts, having a deep groove on their inner sides. In this groove moves a block, and in this block are nuts for the reception of the heavy vertical screws, D. These screws extend up on deck, and are rotated by hand gear, E, so that in this way the block is caused to travel up and down. The block receives the long bush-bearing block, F, which is pivoted therein, and through which the screw shaft passes.

When twin screws are fitted on this system, the ordinary arrangement of central rudder would be employed, and two double-cased vertical radial chambers could be fitted, one under each quarter, for the shafts of the port and starboard screws. The propellers would be in advance of the center stern post, so that the rudder could be put hard a-port or a-starboard without interfering with the action of either screw. In this case either or both of the propellers, separately or simultaneously, would be raised or lowered by similar gearing, as in the case of the single screw.

One advantage which Captain Sadlier anticipates from this invention is that it will admit of much more beam and much less draught of water than in the case of vessels constructed on the ordinary stationary propeller and single rudder plan. He also considers that steamers built with these improvements will possess greater strength, and be safer and better sea boats by reason of these superior properties; and that the carrying capacity will be increased without a corresponding increase in the cost of the construction. In case of an accident to the machinery at sea, rendering steam as a motive power impracticable, the propeller could be raised out of the water, and the vessel could proceed much more expeditiously under sail.

With these improvements it is also pointed out that all necessary repairs connected with the propeller could be made either at sea or in port, without sending the vessel into dock; that the damage which not infrequently results from hawsers fouling the propeller shaft in port or elsewhere would be avoided; and that steamers could be constructed so as to admit of their being shifted without ballast.

Fig. 1.

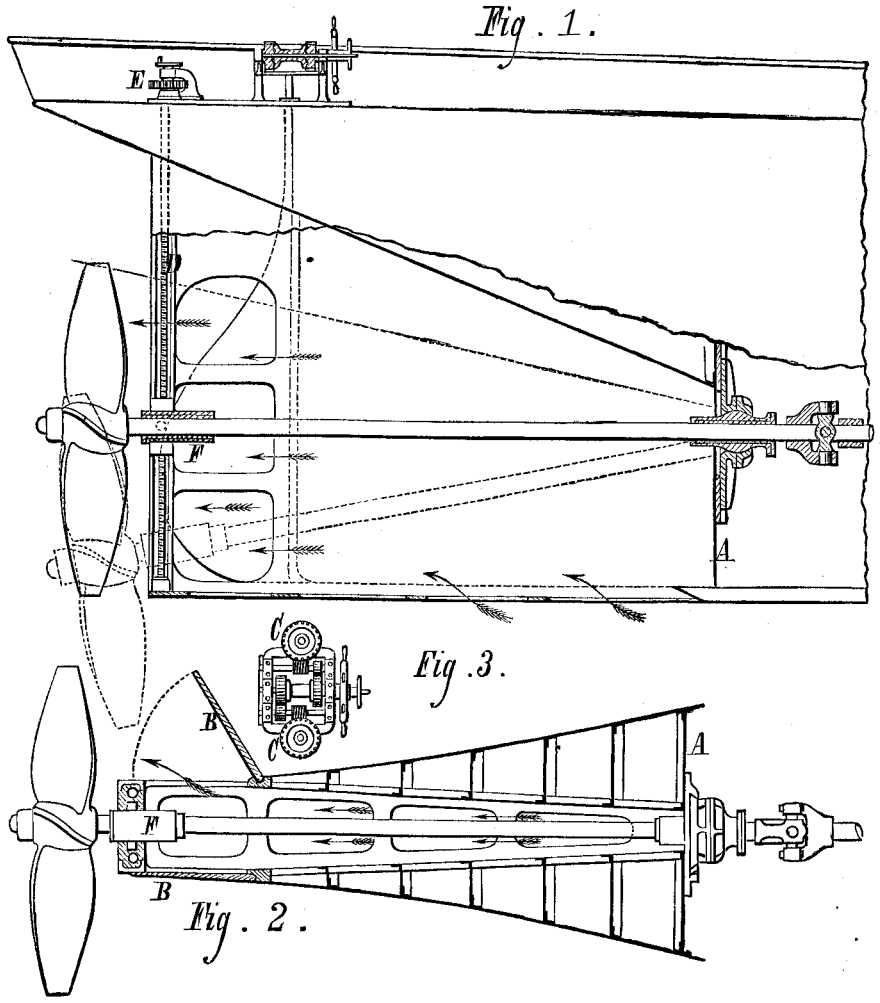

Fig. 3.

Fig. 2.

RAISING AND LOWERING SCREWS.

New Oil Discoveries.

Some excitement has been created in oil circles by the discovery at Sparta, a small city thirty miles north of Oil City, Pa., of an oil-producing sand only twelve feet below the surface. A farmer, while digging a well for water under his barn, found the sand and well immediately filled up with oil of a lubricating variety. New oil property has been discovered on the line of the Philadelphia and Erie Railroad which will add to the prosperity of that road if the discoveries are successfully worked up. Already a ten barrel pumping well has been struck at Stoneham Station, a point five miles east of Warren, and one pumping five barrels at a point five miles northeast of Wilcox. Both of these wells are in new districts, and the discovery will, no doubt, lead to further search.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, February 23, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	6 05 mo.	Saturn sets	6 56 eve.
Venus rises	5 56 mo.	Uranus in meridian	11 43 eve.
Mars sets	11 36 eve.	Neptune sets	10 40 eve.
Jupiter rises	4 57 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	1 50 mo.	Sirius in meridian	8 25 eve.
Regulus rises	5 03 eve.	Procyon in meridian	9 18 eve.
Spica rises	9 39 eve.	Aldebaran in meridian	6 14 eve.
Arcturus rises	8 43 eve.	Algol(2-4th mg.var.)in mer.	4 46 eve.
Altair rises	3 03 mo.	Capella in meridian	6 53 eve.
Vega sets	5 12 eve.	7 stars (cluster) in meridian	5 26 eve.
Alpheratz sets	9 38 eve.	Betelgeuse in meridian	7 34 eve.
Fomal aut sets	4 36 eve.	Rigel in meridian	6 54 eve.

REMARKS.

Mercury and Venus are practically invisible, the former rising only 39m. and the latter 48m. before the sun. Mercury is approaching his superior conjunction, and Venus was at her inferior conjunction February 20, and is now, therefore, morning star, remaining such until December 5, the date of her superior conjunction. Jupiter is still so near the sun that the eclipses, etc., of his moons cannot well be seen. Saturn's rings are still invisible. Uranus is brightest February 16, and as this number reaches its readers before that date, it may be well to state that at that time Uranus may be seen 3m. west and 34m. north of Regulus, passing the meridian 2m. 20s. before the star. His position varies but little from that for this date also. To-morrow morning (February 24) the star Scorpii (3.5 mag.), situated about 2° southeast of Antares, is occulted by the moon, the star apparently passing behind the moon's southern limb. The event will be visible between the parallels of 28° and 62° north latitude. The immersion takes place at 5h. 43m. morning; emersion, 6h. 30m. morning, Washington mean time; duration 47m.

Sound Waves made Visible.

Mr. Sedly Taylor communicates to the Physical Society a process for making sound waves visible to the eye. A hole cut in a piece of cardboard is filled with a film of soap in glycerin, just thick enough to produce bands of color. This card is fastened to a tuning fork, which is thrown into vibration by a violin bow, when the colored film is immediately thrown into vibration, and vortex rings and square bands of color are produced on the screen.

To Kill Lice on Cattle.

A correspondent advises the same method for killing lice on cattle that is employed by florists for exterminating bugs that infect plants, to wit: Cover the animal with a blanket pinned close round the nose, and smoke thoroughly with tobacco. It will destroy the lice, without the bad effects following the wetting with decoctions or the use of grease; a second smoking is seldom necessary.

Curious Telephone Experiments.

The first magnets were about the size usually now employed, ⅛ inch in diameter, and about eight times as long. Ferrotype plates were first used, but these are by no means necessary. Removing these plates, I tried necessarily a number of substances; first, thin tin plate answered perfectly, both for sending and receiving. Sheet iron, about 1-50 inch thick, does not act so well, but all that is said is perfectly understood. While experimenting with these the plates were merely laid on the top of the instrument without being fixed in any way; the topmost wood part with the conical cavity was also discarded, as both transmitting and receiving went on equally well without it. This part of the instrument seems superfluous, as the sound, when the bare plate is pressed flat against the ear, seems louder from the greater proximity. Now, iron plates do not appear to be absolutely necessary, although iron acts better than anything; yet diamagnetic substances act very well. Desiring my assistant, who was some distance off and beyond reach by direct sound in any way, to continue counting for some time, I removed the iron plate and laid across the instrument a broad bar of iron ¼ inch thick. Placing my ear against it I heard every number distinctly, but somewhat enfeebled. A square piece of brass, ⅜ inch, was placed in position; the sound, although distinct, was not so strong as the last. Next, thick pieces of lead, zinc, and steel were tried. The steel acted about the same as the thick iron, and as in the other cases every word spoken was feebly but distinctly heard. Now, some of these are diamagnetic metals, and yet the action goes on. Non-metallic substances were now tried—first, a piece of window glass; this acted very well indeed. With wood—a piece of matchbox—the action was feeble, but on placing other pieces of gradually increasing thickness the sound gradually increased, and with a rough piece of wood 1½ inch thick the sound was perfectly distinct. I next placed an empty wood box in position; this acted very well. A square piece of cork ½ inch thick acted, but rather feebly. A block of Turkey stone 2 inches thick was placed upon the instrument, and with this against the ear the speaker could be followed easily. I now tried without anything at all intervening, and placed my ear close on the magnet and coil, and now, most curious of all, without any plate to vibrate I could hear feebly, and by listening attentively I could understand all that was said. This was repeated many times; mechanical transmission of sound was impossible, as many yards of wire lay coiled upon the ground, and yet without anything (but air) intervening between my ear and the end of the magnet I could understand what was said. Now, all these experiments were one way—the sounds were received. The sounds transmitted (or attempted) acted rather differently. A tuning fork, struck and placed on the thin iron plate or on the woodwork, was heard clearly; for speech, the thin iron plates acted best. With the other substances, the stone, thick wood, glass, zinc, etc., the sound of the fork was heard by it either resting on them or by holding the vibrating prong over them. These thick substances did not answer for the sound of the voice. All these substances were now put aside, and the vibrating prong held directly over the pole of the magnet; this sound was clearly heard, although nothing intervened but air between the vibrating fork and the end of the magnet. The intensity of the sound was not nearly so great by resting the fork directly on the pole as when the vibrating fork was held over the end of the magnet. I next tried if my voice could be heard with this arrangement. The result was rather doubtful, but I think some action must have taken place, for the fork was heard by merely vibrating in the vicinity of the pole, and the effect produced by the voice must have differed only in degree, and was too feeble to be heard at the other end. I have repeated and made quite sure of these results, and have succeeded in transmitting sound very distinctly without a plate over the pole, and have in return distinctly heard all that was said by placing my ear against the instrument—also without any plate whatever. It would seem that to affect the magnet so as to produce induced currents something in the first instance must vibrate in some way, possessed of more *vis viva* than a gas, and it does not seem necessary that the substance be paramagnetic, for diamagnetic bodies act very well.—*B. W. Warwick, in English Mechanic.*

Electrostriction.—A Curious Effect produced upon the Thermometer.

Professor Young proposes to the Royal Society to give the name of "Electrostriction" to a peculiar action of the mercury of a thermometer. If the bulk be chemically coated with silver, and then by the electrotype process covered with the same metal, the mercury will traverse some portions of the scale, and finally take up a definite position independently of temperature. Copper, silver, iron, and nickel constrict the bulk, while zinc and cadmium distend it.

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THE PHYSIOLOGICAL INFLUENCE OF BAROMETRIC PRESSURE.

M. Paul Bert, in the course of his investigation into the physiological effect of changes of atmospheric pressure, has conclusively disproved the popular idea that the deleterious influence of a rarefied atmosphere upon living creatures is due to a mechanical removal of pressure. It has been stated, for example, that blood has gushed from the eyes and nostrils of persons who had attained the summit of very lofty mountains, that aeronauts' heads have been known to swell so that their hats no longer fitted them, and various other doubtful assertions have been made, all finding their justification in this popular notion. M. Bert has proved that such ill effects as are experienced are due not to diminution of pressure, but to diminution of tension of the oxygen, which no longer penetrates to the blood and tissues in sufficient quantity to maintain the vital combustions at their normal degree of energy. In order, therefore, to combat the illness produced by high elevations, it suffices to augment the percentage of oxygen in the air breathed in proportion as the pressure diminishes. M. Bert demonstrates this fact by such simple apparatus as is represented in Fig. 2. A bird is placed under the receiver of an air pump, and the rarefied air, which at first produces symptoms of impending death, is rendered harmless by the addition of oxygen. A is the receiver, *a a'* the barometer, and O a bag of oxygen.

M. Bert has not hesitated to subject himself to similar conditions, and thus to demonstrate beyond question the truth of his theory. The disposition of his apparatus is shown in Fig. 1. The experimenter seats himself in a strong metal box, whence air is exhausted by a powerful air pump. In another receptacle is his bag of oxygen, the tube from which is led to his mouth, and the supply of gas can be regulated at pleasure. The air pressure was gradually decreased until the barometer showed a degree of rarefaction equivalent to that existing at the summit of Mont Blanc. M. Bert's pulse had gradually augmented to 84, when a few respirations of oxygen reduced it to 78, and subsequently to 70. The effect of the oxygen was manifested immediately, and the pulse fell exactly to the normal beat observed before the experiment began.

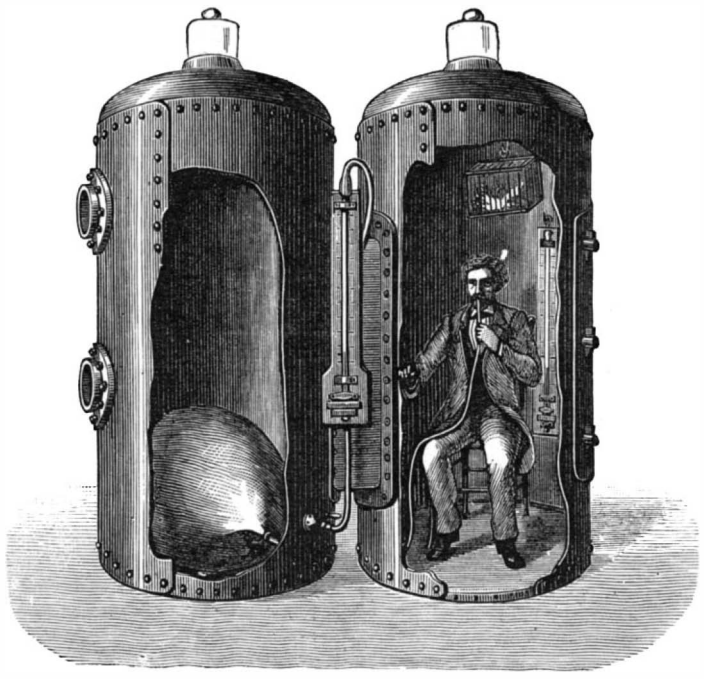

Fig. 1.—MAN SUBJECTED TO RAREFIED AIR.

Female Physicians.

The convocation of the University of London has by a large majority agreed to accept what is called the Supplemental Charter, the effect of which will be to admit women to degrees in all the faculties, on the same conditions as men.

This was done in the very teeth of the Medical Faculty, who in May last declared in the most unmistakable manner their strong protest and decision against the admission of women to medical degrees.

The individual expression of opinion from the leading members of the medical profession in England shows how repugnant this step is to their judgment of the case; how far prejudice may have influenced their course can never be proved, but the high reputation of those who publicly recorded their protest will doubtless be accepted as a guarantee that they conscientiously decided, after due deliberation, that the course they adopted was wise, and for the best interests of the female sex.

Sir William Gull, it appears, considers it the least desirable of all things that women should be encouraged to practice medicine.

Professor Lester claimed that in such a case the Medical Faculty itself should decide the question.

Sir James Paget declared that it would be a scandal and a disgrace to examine women for medical degrees as men are now examined for them.

Sir William Jenner was strongly opposed to the innovation, and condemned the advocates of the women's party, or rather that advanced section of men who wish to thrust women into a false position. Sir William said that he had but one daughter, and he would prefer to see her upon the benches of the dissecting room rather than for her to pursue the course of study necessary to entitle her to take a medical degree.

Probably stronger words could not have been uttered to influence the members of the convocation, but the result of a division showed that there were present a majority who took an equally decided view of the other aspect of the question. The record shows that the ayes were 242 and the nays 132; thus by the large majority of 110 the women were victorious.

As the University of Paris has already permitted women to take degrees, the matter now stands that France and England have decided upon the propriety of educating women for the medical profession, and it appears advisable, now that the question has reached such a state, to consider the consequence, and if possible decide upon a given status for the female physician, so that she may have a defined sphere of usefulness, for which she is eminently qualified and which she can undertake with credit.

Medical men have long recognized a difficulty in the treatment of the large class of complaints usually classed under the term "diseases of women," especially in cases of growing up female children and girls of a certain age.

The full force of our meaning can be realized by a remark made last week by Dr. William T. Lusk, in the course of a lecture at Bellevue Hospital on the diseases of women and children. In reference to certain abnormal complications to which females are subject, he instructed his pupils that, in the case of children and girls of twelve years, it was their duty to ignore the presence of the complaint and let it pass on, rather than by treatment subject the young patient to an examination, the moral effect of which would generate a train of evils of greater magnitude than the disease itself.

This expression of opinion of Dr. Lusk was worthy to be recorded, for it did honor to himself and his profession, at once proving the perfect delicacy and honor with which medical men perform their arduous duties, and how worthy they are of the sacred trust too often forced upon them.

Here, then, appears a sphere in which women may with honor to themselves labor in the cure and relief of bodily infirmities, requiring all the skill and knowledge they can acquire. If women will be physicians, let them devote their energies to the "diseases of women and children," which have been of late years alarmingly on the increase. The medical profession would certainly not grudge to women such a share in their practice, and would probably invite their cooperation, because it would be often beneficial to the patient and insure good results.

Let the "woman," therefore, undertake this honorable *rôle*, so suitable to her nature and fully within the compass of her powers; she will then avoid all the degradations that will fall to her lot in a general practice, which by necessity must at every step place her in a false position.

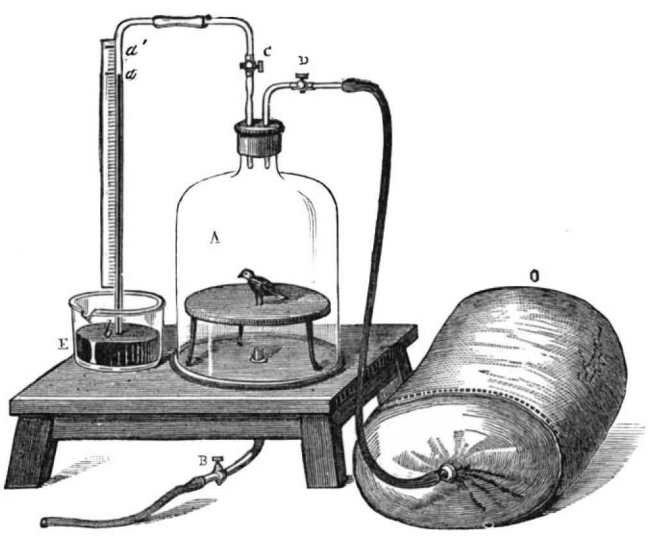

Fig. 2. BIRD SUBJECTED TO RAREFIED AIR.

Medical men have little to fear from the invasion of women upon the practice of medicine; doubtless a large class even of women will still rely upon their services and consult them on most cases.

Men will naturally always take the lead in the medical profession, especially in surgical practice, and if the hour has arrived when the co-operation of female physicians is inevitable, the most prudent course is to take such steps that the education of medical students shall be conducted in such a manner that a mixed class of both sexes shall be unnecessary, and that the studies be arranged to avoid scandal.

In conclusion, we shall be glad to see the female medical practitioner, on the basis here indicated, fairly and well established, as we shall then hope to see the rout of the army of female vampires who are now distributed in every city of the Union, who, under the guise of physicians, clairvoyants, etc., are living on the credulity of the public, a disgrace to their sex and the profession they vainly counterfeit.

SOAP, regarded chemically, is a true salt.

Helminthology for the Year 1877.

Important additions have been made during the past year to our knowledge of this science, and the necessity for more extended investigations is evident. An epidemic of diarrhea was traced to the presence of two nematode worms (*Anguillula stercoralis* and *A. intestinalis*), and the fact that mosquitoes and cyclops have been proved to be the intermediary host of some of the worst sort of entozoa that attack the human system should lend additional force to the timely warning of the helminthologist.

Dr. Cobbold well remarks as a practical comment that, "if physicians will only reflect to what extent diseases hitherto obscure are to be associated with the bite of a gnat, they will perhaps be not less ready than hitherto to extend a helping hand to those who at great sacrifice labor in the field of helminthology."

In Italy good work has also been accomplished, and the great tenacity of life of the insects giving rise to the pork and beef measles has been demonstrated, Dr. Payne and several students having courageously submitted themselves to experiment, and infecting themselves with *Tænia medio-canellata*.

A novelty appears in the production of a work on medicine, written in English by a native Hindoo. It is entitled "Recognizant Medicine, or the State of the Sick," by G. Bholanoth Bose, M.D. Mr. Bose's book is intended to introduce a new system, and is an earnest plea for a more accurate and extended clinical investigation of disease. He maintains that the treatment of disease is taught far too much by rote, and that a name is given for a set of symptoms, and the student is directed to seek for these, when the more important ones may be absent or concealed. Mr. Bose thinks "the state of the sick" should be more thoroughly investigated. The *Lancet* agrees in all this, but believes it is what every intelligent hospital physician is at present inculcating to his students.

Manufacture of Aluminum.

In the most unique factory for the production of aluminum metal, in Salindres, near Alais, the mineral Bauxite is heated with soda in a reverberatory furnace, the resulting aluminate of soda is extracted by means of water, and alumina precipitated by a stream of carbonic acid; this is then formed into balls, with salt and coal, and heated to a white heat in vertical retorts during the introduction of chlorine gas. The double chloride of soda and alumina, which distills over, is fused with the addition of 35 per cent of sodium and 40 per cent of cryolite as a flux, and the metal which settles at the bottom of the crucible is poured into moulds. The cost of producing one keg of aluminum is stated to be 80f., while the selling price is 100f.

A Chemical Prophecy.

Long ago, almost before any one had any definite idea that the liquefaction of oxygen would be actually accomplished, and while many denied the possibility of such a result, M. Dumas, the famous French chemist, on theoretical grounds alone announced the density of liquid oxygen. He reasoned in this wise: Sulphur and oxygen are evidently of the same family. Now, the equivalent of sulphur is 32, and its density is represented by 2. Dividing the first by the second gives 16, which is the atomic volume. Reciprocally knowing the atomic volume and the equivalent, it is easy to determine the density. In the same family of elements it is probable that the atomic volumes are the same. Hence this volume for oxygen as for sulphur must be 16, and this divided by the equivalent for oxygen, or 16, must give the density as a quotient equal to 1, or to the same as that of water.

As soon as M. Pictet had announced his recent magnificent experiment on the liquefaction of oxygen, M. Dumas called his attention to the above and requested him to verify M. Pictet replied that he had obtained just 43·5 grammes of oxygen in liquid state, and that it occupied just 46 cubic centimeters. As the gramme is the weight of one cubic centimeter of water, a more complete verification of M. Dumas's prediction could hardly occur.

A Proposed Liberian Railway.

Congress has been asked for an appropriation of $50,000 to make a preliminary survey from Liberia one or two thousand miles into Central Africa, and to report upon the country, its population, productions, and the practicability of the road. Should the report of the survey be favorable, a company is to be formed to build the road, who are to commence by putting on a line of twenty steamers from Philadelphia or New York to Liberia, which are to carry out railroad material, goods suited to the African trade, and to call at Norfolk and Charleston for colored railroad laborers and colonists, and bring return cargoes of palm oil, coffee, sugar, ivory, gold, and other African products, the trade in which, it is believed, will be vastly increased as it reaches the interior.

ERRATUM.—The date of the Sikes portable cider mill patent, described in our issue of Feb. 9, should read Nov. 6, 1877.

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New Inventions.

A Safety Bridle Attachment, based on the principle of preventing the horse from breathing during the time it is applied, and of quickly removing it so as to relieve the horse when it is no longer needed, has been invented by Mr. Thos. P. Clines, of Louisville, Ky. This device has pads connected laterally by a spring band hung by suitable straps to the head gear of the bridle, and applied or released by means of suitable cross straps or reins.

A new form of Stamped Envelope has been devised by Mr. Joseph Clowes, of Bedford, Pa., the object of which is to provide against the accidental falling off of postage stamps and at the same time enable their being detached by the postmaster, to serve as vouchers. The stamp is in one piece with the envelope, in such a manner that the larger portion is left free and the remainder connected to the flap directly or by a neck, so that it can be removed without injuring the envelope.

Mr. Augustus Hoff, of Brooklyn, N.Y., has designed a Saddle Bag for Physicians which, when opened, gives convenient access to the medicine vials, and protects them from being wet when closed. There is, in connection with a pivoted vial box, a sundry box above it, having an inwardly curved or concave bottom, thus making a compact receptacle. Outside flaps protect the boxes.

M. Franz Dietrich, of Murten, Switzerland, has devised an improved process of treating argols and other residues of wine making for the production of tartaric acid and its salts. The novelty of the process is in the preliminary step, which consists in exposing the wine residues, in a dry state, to a temperature of 140° to 170° C.

An Advertising Lantern, of polygonal shape, with detachable panels, is the invention of Mr. Henry Sylvester, of New York city. The lantern is revolved by clockwork upon a hollow shaft, which also serves as a gas pipe, so that the several sides of the lantern are exposed successively to view.

Messrs. Edgar G. Frisbie and Charles H. Johnson, of Monroe, Mich., have patented a combined Bag Holder and Truck, the object being to furnish a device for holding the bag while being filled, which may also be used as a truck for carrying the bag from place to place.

Mr. Thomas F. Witherbee, of Port Henry, N. Y., has invented an improved Tweer and Blast Nozzle, which consists of the combination, with a tweer having a socket with a spherical joint and a blast pipe, of a short nose piece having a socket or a spherical point for the blast pipe, and used for lengthening the blast pipe or changing the size of the nozzle without sacrificing the main part of the blast pipe. The nose piece is termed by the inventor a "reducing nozzle," and its orifice toward the tweer is smaller than the internal diameter of the latter, thus concentrating the blast for starting the furnace, after which it may be removed.

An improved Window Awning has been invented by Mr. James Cain, of Pittsburg, Pa., which may readily be attached to and detached from the window, and when detached may be folded into a compact form for storage or transportation. The principle is somewhat like that of an umbrella. A horizontal rod carries two sliding runners, the outer one of which is attached to the ribs, and the inner one to stretchers. The outward motion of the inner runner is limited by fixed and locking pins which correspond to the upper catch of an umbrella.

Mr. S. H. Bradford, of New York city, having in view the numerous accidents arising from the careless use of kerosene for lighting fires, has contrived a combined Kindling-wood Receptacle and Oil Can. The can is divided into two compartments by a perforated draining disk. The kindling wood being placed in the upper end, the can is closed and reversed, the wood thus being saturated with oil. When this is accomplished the can is turned back and the fluid drained from the wood. By suitable arrangements the oil is kept from dripping and the wood kept in position.

A Feather Renovator, or apparatus for steaming and then drying feathers, so as to cleanse and renovate them, has been invented by Messrs. G. B. Griswold and J. C. Gipson, of Felt's Mills, N. Y. It consists of a revolving cylinder with inclosing jacket, arranged in connection with a radial steam pipe and valves, so that the steam may be first admitted into the cylinder for steaming and then into the jacket for drying.

An improved Pottery Kiln is the invention of Messrs. Isaac and Griggs Marsh, of Milton, Pa. The kiln has furnaces at the sides, and is provided with flues for conveying the products of combustion to the top of the kiln, while a central chimney, with a downward draft, opens into the lower part of the kiln, to more perfectly bake the wares contained in it.

Messrs. R. G. and C. G. Lindsay, of Hollidaysburg, Pa., propose a new mode of Constructing Buildings, intended to combine the qualities of non-conductivity of heat, absence of condensation of moisture on the inner wall, and economy of construction. A wooden frame is sheathed and connected with an outer brick wall or casing by metal ties, leaving a dead air space between.

An improved Folding Bracket Chair for use in public places has been invented by Mr. Walter A. Brewster, of Woodbury, N. J. The seat is carried on a swinging bracket, and when not in use the back and seat fold down upon the bracket, and the whole is swung back out of the way. By a single motion of the hand the seat may be adjusted or folded.

Mr. Joseph R. Payson, of Chicago, Ill., has invented a Joist Shoe for supporting the ends of flue joists in the breasts of chimneys, so constructed that the ends of the joists are not exposed to fire by entering the wall, and that the use of trimmers and headers may be dispensed with. The shoe is a casting having two flanges at right angles to each other, with a web extending diagonally across the upright flange and at right angles across the bed flange. Thus the shoe is divided in two parts, one of which is built into the wall, while the other receives the end of the joist, which is secured by screws or spikes driven through holes in the flanges and set at suitable points.

A Service Valve for Waterpipes, especially when exposed to freezing, by which the water may be drained off as soon as the supply valve is closed and the escape instantly shut off when the valve is opened, has been patented by Mr. Paul Magnus, of New York city. A screw spindle operates a fixed supply valve and a sliding drain valve simultaneously.

An improved Process of Tanning Leather has been invented by Mr. George Goodwin, of Cookshire, Canada, and is designed to make waterproof leather for boots, gloves, harness, etc. The tanning bath consists of sulphuric acid, alum, japonica, salt, and water or bark liquor, used in proportions prescribed.

A new invention by Mr. Wm. Riker, of Newark, N. J., relates to an improved Method of Inlaying Gold, Silver, Platinum (or other suitable metal) in Gold or Silver. The method consists in cutting the forms which constitute the emblems or configuration from a bi-metallic plate, or a plate having upon one side the color of metal which gives distinctiveness, and upon the other a metal of the same quality and color as the back of the main portion of the piece of ware to be inlaid, so that when the emblems are inserted and soldered into the apertures cut through the body piece said emblems appear upon the face in different colors, while the backs of each being of the same color and quality of metal as the back of the main body, the reverse side of the emblems is not distinguishable.

Herr Albert Lüttges, of Solingen, Prussia, has invented a new Apparatus for Hardening and Tempering Sheet Steel, the purposes of which are: first, conducting the sheet steel through a heating oven; then hardening it between cooling vessels, which are pressed upon it with more or less power; and, finally, tempering the steel by passing it between the bridge of a box heated by charcoal or otherwise, and a block pressing upon the latter.

Mr. G. A. Wells, of Hopkinsville, Ky., has patented an Ink for use upon State and Government records and documents, also in banking and other kinds of business generally—a writing fluid or ink which is indelible and will therefore afford the desired protection against loss either by forging or the effect of moisture. The ink is composed of water, borax, shellac, lampblack, and camphor. It is very dark, flows freely from the pen, will resist water, and is ineffaceable by chemical agents.

Mr. W. E. Buser, of Chillicothe, Ohio, has devised an Attachment for Bureau Washstands, and other analogous articles of furniture, which consists, first, of a detachable frame adapted to be secured to the back of the washstands, and provided with projecting arms for supporting towels or other articles of toilet, etc.; and second, of a splasher, formed of a piece of any suitable fabric, which is attached to the back of said frame by means of studs or buttons, so that it may be readily removed when soiled.

Mr. Luther J. Adams, of East Templeton, Mass., has invented a combined Cradle and Crib, which may be rocked with facility when used as a cradle and easily secured in rigid position for a crib by pivoted locking pieces.

Microscopical Notes.

ROYAL MICROSCOPICAL SOCIETY, January 2, 1878.—Dr. Bartlett read a paper "On the detection of toxic matter connected with typhoid and other enteric diseases." In the course of reading this paper he gave an account of his attempt to trace to its ultimate source the cause of a recent outbreak of typhus fever, and showed that while chemical analysis had failed to discover any impurity either in the water or milk, he had been able by means of microscopical examination to detect certain bodies, presumably of fungoid character, which were identical with those found in the bowels of persons who had succumbed to the disease.

A SECTION OF A BONE of the *Megalosaurus bucklandii* was exhibited by Mr. Flack, and its remarkable resemblance to the structure now identified as peculiar to birds was pointed out by Mr. C. Stewart.

FUNGI.—Mr. W. G. Smith recently showed before the Linnæan Society some drawings of the fungus *Boletus subtomentosus*, to demonstrate that in a specimen 5 inches in diameter there were 17,000 pores or tubes. Each pore when cut across showed 2,000 cells. The number of surface cells on the under side of a specimen is 36,000,000. The cells in an entire plant are calculated to number 615,000,000,000, and the number of spores produced by the same plant to be 5,000,000,000.

ALGÆ AND DIATOMACEÆ.—Professor Dickie, in a paper read before the same society, stated that in the collection made by the last Arctic expedition there were representatives of fourteen genera of Algæ, many of which were common in Europe. Of Diatomaceæ, 31 genera and 70 species had been identified, most of which were marine.

QUEKETT MICROSCOPICAL SOCIETY, December, 1877.—Mr. Cattam drew attention to the new autographic process, in which he pointed out its difference to ordinary lithography, and indicated its superiority to the latter process as a means of illustrating the finer details of microscopic drawings.

MOSQUITOES.—Dr. Spencer Cobbold announces a discovery in Helminthology which has very important relation to the origin of many obscure diseases.

Mr. Bancroft wrote from Brisbane, Australia, in April, 1877, and incidentally remarked:

"I wonder if mosquitoes could suck up the hæmatozoa and convey them to water. They appear to die in water. I will examine some mosquitoes that have bitten a patient, to see if they can suck up the 'Filariæ.'"

It appears that what Bancroft surmised Dr. Manson demonstrated to be a fact.

On November 27, 1877, Dr. Manson wrote from Amory to Dr. Spencer Cobbold, when he announced the discovery in the stomachs of the mosquitoes, which had fed on hæmatozoal patients, and he sent a voluminous manuscript in which he not only described the developmental changes which the parasite undergoes during its residence in the stomach of the insect, but he also supplements the 15 cases of human hæmatozoa by giving details of no less than 35 additional cases, and a mass of valuable statistics in relation to the prevalence of *Filaria sanguinis hominis*.

Thus what the Russian traveler and helminthologist Tedschenko showed in relation to the case of the "cyclops," considered as the intermediary host of the Guinea worm, Manson has shown to obtain in the case of the *Culex mosquito*. True there was a difference in detail, but both play the rôle of intermediate bearer, the little crustacean and the small gnat.

NEW YORK MICROSCOPICAL SOCIETY, February 1, 1878.—A paper was read by Professor R. Hitchcock on the subject of "Salicylic Acid in Mounting." This, it was alleged, was useful in developing certain detail of vegetable forms. A member present stated that whatever merit salicylic acid may possess, there was one drawback to its use, as he found by experience—that it was destructive to the color of the specimen.

The Late King of Italy.

The proximate cause of King Victor Emanuel's death was asphyxia, due to the complete arrest, from red hepatization, of the function of the right lung, the function of the left having already been impaired by precisely the same malady, from which His Majesty suffered at his shooting box of San Rossore, in 1869. As in the generality of such diseases, when contracted under the "malarial cachexia," there was a copious sudaminous eruption, the "miliary fever" of the Italian text books. But this rather relieved than aggravated the symptoms, and left the cause of death, as has been stated, asphyxia. The inhalation of oxygen, which was practiced at the close, was intended to mitigate the august patient's sufferings, which by that time had become extreme. Just before this Dr. Bruno, as His Majesty's oldest medical adviser, was charged with the painful duty of announcing the hopelessness of all earthly aid. The King, sitting back, and twiddling his thumbs, as was his wont when making inquiries, asked, "Are the symptoms, then, so grave?" Dr. Bruno added, what the already shortened breath and gasping utterance of the patient had too plainly expressed, "They are," and recommended to His Majesty the last consolations of the Church. "Let the chaplain enter," said the King, in the same brief but tranquil tone. And then followed the ceremony and the scene with which the English public are by this time familiar. He died with a tranquillity truly marvelous, considering the conditions of death—died, as he had lived, a cool and intrepid soldier. —*Lancet.*

Inventions Patented in England by Americans.

From December 21, 1877, to January 10, 1878, inclusive.

AERO-STEAM GENERATOR.—T. L. Jones, St. Louis, Mo.
BLAST FURNACE.—J. F. Bennett, Pittsburg, Pa.
BOOT HEEL.—J. Dalton *et al.*, New York city.
CHAIR, ELEVATING.—S. S. White, Philadelphia, Pa.
DOOR AND WINDOW FASTENING.—N. Thompson, Brooklyn, N. Y.
DOOR LATCH.—C. Walton, Philadelphia, Pa.
FEED WATER APPARATUS.—F. A. Pratt, Hartford, Conn.
FIBER-TREATING MACHINE.—R. Kitson, Lowell, Mass.
GRINDING AND SEPARATING MACHINE.—D. C. Newell, New York city.
HAT LINING.—W. L. Bigelow, Boston, Mass.
HULLING MACHINE.—J. C. Vincent *et al.*, New York city.
INGOT MAKING.—B. C. Lauth, Pittsburg, Pa.
KERITE.—A. G. Day, New York city.
KNITTING MACHINE.—C. J. Appleton, Philadelphia, Pa.
LABELS, ETC.—C. C. Macbrair, Cincinnati, O.
LAMP BURNER.—C. F. A. Hinrichs, Brooklyn, N. Y.
LOG.—D. Carroll, Spring Creek, Pa.
NUT LOCK.—J. Jones, Chicago, Ill.
NUT LOCK.—E. Reese, Baltimore, Md.
OAKUM MACHINE.—J. M. Blake, New York city.
PACKING BOX.—H. C. Stone, Brooklyn, N. Y.
PANTALOONS.—M. Krickl, New York city.
PEN AND PEN HOLDER.—J. Reckendorfer, New York city.
PIPE JOINT.—W. Painter, Baltimore, Md.
PLOW (2).—L. Chapman, Collinsville, Conn.
REGULATOR CLOCK.—E. J. Muybridge, San Francisco, Cal.
ROTARY PUMP.—T. Wilbraham *et al.*, Philadelphia, Pa.
SEA SICKNESS, PREVENTING.—J. Commins, Charleston, S. C.
SHOE MACHINE.—B. F. Larrabee, Lynn, Mass.
SHUTTER.—Wm. Menzies *et al.*, New York city.
SIGNAL LIGHT.—C. F. Haughton, Corning, N. Y.
SOLDER WIRE, ETC.—H. G. Hulburd, Placerville, Cal.
STEAM GENERATOR.—Automatic Boiler Company, New Haven, Conn.
STEERING AND PROPELLING VESSELS.—W. W. Shoe, Philadelphia, Pa.
STONE-SAWING MACHINE.—W. Radcliff, New York city.
STOPPER AND BUNG.—F. A. Howig, San Francisco, Cal.
STOVE.—C. W. Durham, Chicago, Ill.
STRAW-SEWING MACHINE.—S. C. Brown, Philadelphia, Pa.
STRAW-SEWING MACHINE.—S. Henshall, Philadelphia, Pa.
SUGAR-COMPRESSING MACHINE.—A. F. W. Partz, Philadelphia, Pa.
TRANSMITTING POWER.—R. Farley, Jr., New York city.
TRUSS.—J. B. Brown, Chicago, Ill.
TYPE WRITER.—G. W. N. Yost, New York city.
UTILIZING STEAM POWER.—W. R. Comings, New Britain, Conn.
VEHICLE SPRING AND AXLE.—S. W. Ludlow, Cincinnati, O.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Laboratory 33 Park Row, N. Y. Fuller & Stillman.

Alcott's Turbine received the Centennial Medal.

Wanted.—Parties to Manufacture my Improved Pipe Coupling on Royalty. Illustrated in Sci. Am. Jan. 26. E. S. Chapell, Pembroke, Maine.

Silver Plater's Sets for Amateur, $5. Batteries, Baths, Silver Solution, and Connections. Union Silver Plating Co., Princeton, Ill.

Machinery for Starch Manufacturers wanted. Address Keuffel & Esser, 127 Fulton St., New York.

Telephone Magnets. Electric Supply Co., Box 611, Providence, R. I.

Manufacturers of Self-binding Reapers, send price, etc., to J. B. Reichard, El Monte. Cal.

Wanted.—Tools for Sewing Machine Factory. T. Shanks, Baltimore, Md.

Wanted.—Partner with $3,000 to $5,000. Machine and Foundry business; good prospects. 115 Carroll St., South Brooklyn, N. Y.

All kinds of Machine Work, Iron and Brass Castings, at lowest rates. 150 Van Brunt St., South Brooklyn Iron Works, South Brooklyn, N. Y.

For Sale.—One English made Lathe, 28 in. swing, 16 ft. bed, compound rest; price $150. The Bullard Machine Co., limited, 14 Dey St., N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For book on Lubricants, R. J. Chard, 134 M. Lane, N.Y.

For Sale.—4 H. P. Baxter Engine, second-hand; 5 H. P. Yacht Engine and Boiler; Box 630, Hartford, Conn.

Supplies for Telephone and other Electrical Experiments at manufacturers' prices. Jerome Redding & Co., 30 Hanover St., Boston, Mass.

For Sale.—Machinery and Compositions of all kinds of Matches. Apply to J. H., P. O. Box 942, N. Y. city.

Canadian Patent For Sale.—Mey's Dryer for Grain, Malt, etc., has been in practical use for several years in Buffalo, N. Y. Address F. H. C. Mey, Buffalo, N. Y.

For a 15 in. Swing Lathe having 1⅝ in. hole through Head Spindle, something new, address Star Tool Company, Providence, R. I.

2d Hand Iron Planer built by Smith of Salem. Plane 13 ft. x 30 in.; price $300. A. C. Stebbins, Worcester, Mass.

Cornice Brakes. J. M. Robinson & Co., Cincinnati, O.

Noise-Quieting Nozzles for Locomotives, Steamboats, etc. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Shaw's Mercury Gauges, U. S. Standard of Pressure. 915 Ridge Ave., Philadelphia, Pa.

Vertical Scientific Grain Mills. A. W. Straub & Co., Phila.

Corliss Engine Builders, with Wetherill's improvements, Engineers, Machinists, Iron Founders, and Boiler Makers. Robt. Wetherill & Co., Chester, Pa.

The Niles Tool Works, Hamilton, O., have second-hand Machine Tools in first class order for sale.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor; can be stopped instantly; also Upright Mill Spindles, Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Conn.

Wanted.—Second-hand Gun Stocking, and other Gun Machinery. Address V. A. King, Lock Box 81, New Haven, Conn.

Bound Volumes of the Scientific American.—I have on hand about 200 bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 126. John Edwards, P. O. Box 773, N. Y.

Vertical & Yacht Engines. N.W. Twiss, New Haven, Ct.

Having dissolved partnership July 1, 1877, we have still on hand and for sale a very large amount of new and 2d hand machines. See our notice on page 93. Steptoe, McFarlan & Co., Cincinnati, Ohio.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N. J., gave the best results at Centennial test.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., U.S.A.

Fine Taps and Dies for Jewelers', Dentists', and Machinists' use, in cases. Pratt & Whitney, Hartford, Ct.

Weldless Cold-drawn Steel Boiler and Hydraulic Tubes. Leng & Ogden, 212 Pearl St., N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Electrical Goods of every description, Annunciators, Bells, Batteries, Wire, Electro-plating Apparatus, etc. Finger, Risteen & Co., Melrose, Mass.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 126.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B. C. Machinery Co., Battle Creek, Mich.

Blake's Belt Studs are stronger, cheaper, and more durable than any fastening for Rubber and Leather Belts. Baxter's Adjustable Wrenches fit peculiar corners. Manuf. by Greene, Tweed & Co., 18 Park Place, N.Y.

Wanted.—A situation as an apprentice in a Steam Engine Manufactory by a young man who wishes to become a steamboat engineer. Good references. Address Mackay Munro, Wilmot, N. S.

Wanted immediately.—A man to manufacture and sell Norton's Complete Flexible and Detachable Harrow in the United States, also to take out foreign patents. Address Lyman Norton, Hartford, Washington Co., N.Y.

Wanted.—A strictly reliable Manufacturing Company to take charge of manufacture and sale of Lempert's Faucet—see Scientific American of Dec. 8, 1877—or purchaser for Patent Rights. W. S. Lempert, Fort Davis, Texas.

Wanted.—Second-hand Ice Machine, system Carré, of about a thousand pounds capacity in 24 hours. Address, giving price, H. A. S., Box 6, San Antonio, Texas.

For Power & Economy, Alcott's Turbine, Mt. Holly, N.J.

NEW BOOKS AND PUBLICATIONS.

OUR MERCHANT MARINE. By Chas. S. Hill. Third Edition, revised. D. Appleton & Co., publishers, 549 and 551 Broadway, New York.

The writer of this little work aims to show the policy of our government as to internal improvements, compared with the neglect to ocean service; the policy of other nations as to their merchant marine; and lastly what we have lost to our commerce and how to repair our condition. A large amount of statistics and many forcible arguments are adduced in support of his views.

JOURNAL OF THE SOCIETY OF TELEGRAPH ENGINEERS. Nos. 15 to 19, inclusive. E. & F. N. Spon, publishers, 446 Broome St., New York.

The above numbers of the journal contain the proceedings of the society named from April 26, 1876, to May 9, 1877, besides a large number of valuable original communications. The principal papers included are those by Mr. Latimer Clark on Clamond's Thermo-Electric Battery, Mr. Roberts on Batteries, Mr. Risch on Double Current Translation, Herr Treuenfeld on Fire Telegraph, and Mr. Preece on Shunts. These papers are well illustrated and are exhaustive as to their subjects, while embodying the latest results of investigation.

GRUNDLINIEN EINER PHILOSOPHIE DER TECHNIK. Von Ernst Kapp. Braunschweig (Brunswick), 1877.

"That many subjects of an empirical nature have of late been treated in a philosophical manner is a pleasing proof," says the author, "that empiricism and speculation need to be supplemented one by the other." To supply just such a need existing in that branch of technology known as "mechanics" Dr. Kapp has written the present work. Believing that man, by the work of his hands, has translated the unknown forms, the hidden functions, and the normal proportions of his bodily members, it has been the author's aim to show in these pages the state of mechanism arrived at by following organic models as well as an understanding of the human organism by means of mechanical contrivances, as the only way possible of obtaining a knowledge of the "limits of human activity." It would be impossible in a short notice like this to follow, step by step (or even outline), the arguments by which the author reaches his conclusions, and we must therefore be content to simply call the attention of our readers to this book as an important contribution to German scientific literature, which we hope some enterprising publisher will put forth in an English dress, so that every one interested in such subjects may enjoy it.

A DIGEST OF THE LAW OF TRADEMARKS. By Chas. E. Coddington, Counselor-at-Law. Ward & Peloubet, publishers, New York City.

This volume contains a digest of all the reported and a few of the unreported adjudications in the courts of the United States, Great Britain, Ireland, and Canada, and of the principal decisions in the courts of France; the treaties between the United States and Foreign Countries; the statutes of the United States concerning trademarks, and the rules and forms of the United States Patent Office for their registration. The volume supplies a long felt deficiency, and will prove of much value to the legal profession.

THE APPLICATION OF ELECTRICITY TO RAILWAY WORKING. By William Edward Langdon. Macmillan & Co., publishers, New York City. Price $1.75.

The object of this work, says its author, is to set before each and all alike not merely the uses to which electricity may be applied in the advancement and for the protection of railway traffic, but also the rules and principles which should regulate its practice. The volume is divided into three divisions, namely, speaking telegraphs, block signaling, and miscellaneous appliances. Under the first heading are chapters on signaling instruments and regulations governing their use, single line working and supervision and circuit arrangement. The various systems of block signaling are taken up in turn, the information being carried down to the latest dates, and finally, under the last heading above noted, are considered signal repeaters, interlocking levers, bells, indicators, and train intercommunication. The author writes clearly, explaining with much care and perhaps with even more detail in elementary matters than might be looked for. There is a profusion of engravings and an appendix of forms, relating, however, to English practice.

Messrs. N. W. Ayer & Son, advertising agents, of Philadelphia, Pa., issue a manual containing carefully prepared lists of leading daily, weekly, and monthly papers, and a large amount of information valuable to advertisers and business men.

Annales des Ponts et Chaussées, Paris. December, 1877.

The December number of this publication, just received, in no respect falls short of its predecessors in the value of its contents to the engineering profession. The Mémoires contained in the present number are: No. 66, calculations of the strength of metallic girders supporting road-bridges; No. 67, on the conditions regulating the establishment of railways for small traffic; No. 68, report of the committee appointed to pass opinion on a new process for purifying the sewage waters of Reims; No. 69, on canals. The latter half of the publication is devoted to new laws and legal decisions that are of interest mainly to French engineers.

ECONOMIC MONOGRAPHS. G. P. Putnam's Sons. 1878. No. II. The Silver Question, by David A. Wells. No. III. The Tariff Question, by Horace White.

The able views held by these two distinguished authors, being well known to the public, need not be repeated here. These little monographs are a model of typographical neatness, and are put forth in a very convenient form for reference.

Rivista Europea—Rivista Internazionale. Florence (Italy), January, 1878.

The present number of this able Italian review contains, as its initial article, one of especial interest to scientists, entitled the "Trial of Galileo Galilei." The remainder of the periodical is devoted to literature and European politics.

The Princeton Review. January, 1878.

The present number of this review makes its appearance with the following table of contents: Divine Retribution; The Church and Civil Law, in Scotland and America; the Eastern Problem; Catholic Elements in Presbyterianism; Christian Theology in its vital form and positive Attitude; Genuineness of the Pentateuch; Evolutionism respecting Man, and the Bible; Conditions of Successful Prayer; Contemporary Philosophy—Historical; Materialism and the Pulpit; Casuistry—Theological and Legal. In the article on "Evolutionism respecting Man, and the Bible," Dr. Duffield in a temperate manner discusses the question: "Is evolutionism, as it respects man, consistent with the Bible?" Taking issue with the eminent scientists, both Romanists and Protestants, who maintain that in evolutionism there is nothing hostile to the system of truth revealed in the Scriptures, he discusses the subject in all its bearings and deduces the conclusion that "it is not only inconsistent with the Scriptures as to man's origin, the nature of sin, and man's original and present spiritual condition; its teaching as to the future of the human race is alike irreconcilable with the teaching of the Scriptures as to the way of man's salvation, its nature, and man's destiny." In concluding his remarks he makes the following disposition of those who differ in opinion with him on this subject: "If the development theory of the origin of man shall in a little while take its place—as doubtless it will—with other exploded scientific speculations, then they who accept it with its proper logical consequences will, in the life to come, have their portion with those who, in this life, 'know not God and obey not the gospel of His Son.'"

Notes & Queries

(1) B. A. W. asks: 1. What thickness of lead and copper plate, and what sizes, will be required in a small battery (for silver and nickel plating)? A. The lead plate may be $\frac{1}{16}$ inch or less in thickness; copper, $\frac{1}{4}$ inch or less. Use three cells, exposing about 200 square inches surface of zinc; plates about six inches square will answer. 2. Will common bar lead, melted and moulded, and stove zinc answer? A. Yes.

(2) M. S. asks: How can I make glass and tin adhere firmly together, so as to hold oil without leaking after awhile? Oil will work through almost anything. I have tried plaster of Paris, a number of cements and other mixtures, but without success. A. Try the following: Soak isinglass in water till it is quite soft; then dissolve it in the smallest possible quantity of proof spirit over a hot water bath; in 2 ozs. of this dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit; stir well together and use warm. 2. Add softened gelatin to about one half its weight of hot glycerin. 3. Gum shellac dissolved in a concentrated hot aqueous solution of borax; concentrate by evaporation. 4. Slake caustic lime with a little boiling water, beat it into a paste with white of egg or blood, and use immediately. Paper pulp may be added to the first three cements.

(3) W. C. A. writes: 1. Can you give some simple process of preparing the inside of oak casks, so that they will not color white liquor—spirits or gin? A. Gelatin or fine glue solution has been used for the purpose. 2. Spirits spilled on oiled or varnished furniture leave a milk-like stain. What will take it out? A. Rub with a little moist tripoli on chamois skin, and then with a drop of oil.

(4) F. W. S. asks: 1. What are rum, brandy, and whisky made from, and how? A. Rum is the spirit obtained by distillation from the fermented skimmings of the sugar boilers, molasses, the juice of the sugar cane, etc. Whisky is nominally the dilute spirits obtained from the distillation of fermented wort of malt or grains, potatoes, etc. Pure brandy is the spirit obtained from the distillation of wines. 2. How are herb extracts made? A. Extracts are usually obtained by heating or boiling the substances repeatedly with water (in some cases with dilute spirit) and rapidly evaporating down the several liquors obtained (after allowing to stand a few hours and straining through flannel) over a water or steam bath. See p. 286, Cooley's "Cyclopædia of Receipts and Processes."

How can blades cut out of iron be tempered to fine steel, so as to take and retain good cutting edge? A. If soft, by packing in a tight earthen box with fine charcoal, made into a thick paste with molasses, and exposing to a dull red heat for a week, re-heating, rolling, and quenching in cold water.

What chemical will rapidly destroy wood? A. A mixture of potassium chlorate and nitric acid, or of chromic acid and oil of vitriol.

What will eradicate the taint of coal oil from pewter, tin, or other metallic vessels? A. Hot soap and water; naphtha; carbon disulphide.

(5) E. E. M. asks how the musical tones are produced by common glass tumblers partly filled with water? A. By striking their rims with a little mallet or hammer, well padded with chamois leather; or by drawing a well rosined bow over their rims. A sufficient quantity of water is poured in each glass to give it the desired tone.

(6) C. E. H. asks whether there is any accepted standard pitch of screw threads for general brass-fitting work, such as glass gauge fittings, marine cocks, etc.? A. For brass nozzles, pipe couplings, and faucets there is. For general brasswork the thread pitch is finer than for iron or steel work.

(7) C. A. T. writes: 1. I have a helix 8 inches long, containing 200 feet of No. 18 wire. What size and length of wire shall I use for the secondary coil? A. Use 1 lb. of No. 40 copper wire—silk insulation. 2. Whose battery will give the greatest shock? A. Daniell's—use two cells. 3. Does a secondary coil weaken the power of the helix for making permanent magnets? A. Yes. 4. I made a porous cup of white pine wood, $\frac{3}{32}$ inch thick. It was a failure. Why? A. It opposed too much resistance to the passage of the electric current through the solutions of the battery.

(8) H. H. asks: Will paper macerated with nitric and sulphuric acids explode like gun cotton? A. Good unglazed paper, exposed for a few minutes to the action of a mixture of about equal parts fuming nitric and sulphuric acids, thoroughly washed in water made slightly alkaline with soda, and dried, has the composition and properties of gun cotton.

(9) J. O. K. P. asks: Can you give me recipes for colored fires, such as used for theatrical purposes, which will not emit noxious fumes? A. The powerful light from large oxyhydrogen lamps (calcium light), colored by the interposition of suitably stained glasses or gelatin films, is now generally substituted, and gives much better results.

(10) J. W. asks for a recipe for a waterproof dressing for leather or dry hides? A. Add to a boiling solution of common yellow soap, in water, solution of alum or alum cake (sulphate of alumina) as long as a separation of white alumina soap takes place; allow the precipitate to subside, wash it with hot water, heat moderately for some time to expel adhering water, and dissolve the semi-transparent mass in warm oil of turpentine. The solution may be applied by brush or by dipping and rolling. Oil and colors may be added to the bath and the substance dried in the air, or more rapidly in a drying room at 90° to 100° Fah., with care to prevent fire.

(11) E. L. R. writes: I have constructed one of Hill's gravity batteries, and it is imperfect. I get about as strong a current from one cell as from twelve. The zinc is from the ends of matting, and the hangers of brass ½ inch wide, ⅝ inch thick, No. 16 gauge, insulated with a thin coat of gutta percha. The battery is charged with ½ lb. sulphate of zinc and ½ lb. sulphate of copper to half a gallon of water. With a soft iron magnet one cell produces a current strong enough to hold 3½ lbs., and the twelve cells are only able to sustain about 4 lbs. Where is the trouble? A. It is very likely that your zincs contain lead, and as this will cause local action, and interfere with the current of electricity produced by the battery, it would be advisable to procure new zincs. It is also possible that the wire that is wound on your electro-magnet is too coarse, and therefore has too little resistance for an intense current, such as is produced by a number of cells.

(12) J. M. G. asks: Is there a chemical process known by which the spectrum of a burned flower may be "raised from its ashes?" A. Moisten the ashes with a little pure hydrochloric acid and glycerin, gather a little on the loop of a thin platinum wire and expose it to the hottest part of the flame of an alcohol or Bunsen gas lamp, at the same instant viewing the flame through a good spectroscope.

Is there a cement by which a piece of ivory can be cemented to brass or steel? A. Melt together equal parts of good pitch and gutta percha; use hot.

(13) H. S. writes: Can you give me a recipe for making hair dye such as is used in barber shops? Also, a wash or solution which is used before and after dyeing the hair, mustache, and beard, and directions how to use it? A. Cleanse the hair with dilute ammonia water. Then moisten it uniformly with dilute solution of gallic acid or ammonium sulphide, and go over it with a comb moistened with solution of one part nitrate of silver in nine parts of water, touching the scalp as little as possible. Stains may be removed by applying a little dilute solution of iodine in iodide of potassium dissolved in water, and then with solution of sodium hyposulphite.

(14) H. E. E. says, in reply to W. B. H., who asks for the best process for tempering mainsprings for gun locks, and for best steel for that purpose: I have obtained best results with fine cast steel, being careful not to heat above a dull red in hammering as well as in hardening; quench in lukewarm water, then smoke the spring in the blaze of a lamp or resinous wood until it is very black, and heat gently until the soot burns off.

(15) A. J. asks: How long does it take a signal to pass from America to Europe by marine telegraph? A. About ¼ of a second.

Was the paper money issued by the Continental Congress ever redeemed? A. No. In 1781 the depreciation was in the ratio of 200 and 500 to 1, and in that year all former tender acts were repealed.

(16) J. D. R. writes: I have read that the Continental Telegraph Company were about to use a combination of the Morse instrument and the telephone. Is such a combination possible? A. The combination refers to the use of the two systems of communication, not to a combination of the two instruments.

(17) G. W. R. asks: 1. Is the Atlantic cable laid in pipe through the ocean? A. No. 2. If not, how is it laid? A. It is protected by an armor of heavy

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iron wire wrapped around it, and resembles a solid rope of wire.

Is there any known thing that travels faster than light, and what is its rate? A. Light travels through space at the rate of 192,000 miles in a second of time. According to Wheatstone static electricity travels along a copper conductor at the rate of about 288,000 miles in a second; but Fizeau's experiments make it 112,680 miles per second, and Walker's only 18,000; while subsequent investigation points to still lower figures—perhaps even only 3,000 miles per second. The matter is still in dispute.

(18) P. S. S. asks: How can I bronze gun barrels? A. See SCIENTIFIC AMERICAN, vol. 36, p. 203, (36).

How can a name be copied from type so as to make a hand stamp? A. By driving the type into wet blotting paper; when the paper is dry, it is removed from the type, and may be then used as a mould, from which a casting may be taken by pouring melted type metal over that surface of the blotting paper which was against the type.

(19) R. B. R. writes: I have a varnish cask, copal or shellac, which I wish to use to make a filter for drinking water, but I cannot remove the smell and taste of varnish. How can the difficulty be overcome? A. Fire the inside, and choke the flame by inverting or covering it after a few minutes, or as soon as the wood begins to char.

(20) J. W. D. asks for a recipe for a cheap jet black for leather. A. The iron-logwood preparation is cheapest, and for ordinary work gives the best satisfaction. You may try the following: Go over the work with hot argol water, then apply a strong hot solution of bichromate of potash in slight excess, and immediately afterward hot logwood solution. A trace of indigo extract may be added to the logwood to correct any reddish cast.

(21) T. A. J. asks how to copperplate steel knives. A. Dissolve about 1 oz. of sulphate of copper in 1 quart of rain water, and to this add a solution of 3 ozs. of cyanide of potassium in 1 quart of rain water; stir the two solutions, and add 2 ozs. of ammonia water. This is called the "bath," and the articles to be plated are first thoroughly cleaned, then connected by a wire with the negative or zinc pole of the battery, and a sheet of copper is similarly connected with the positive pole of the battery, and both placed in the bath, facing but not touching each other.

(22) S. W. T. asks: What paste is best for pasteboard? A. An excellent paste for this and similar purposes is made as follows: 4 parts, by weight, of glue softened in 15 parts of water, then heat with the water until a clear solution is obtained, and add 65 parts of water with stirring. Mix 30 parts of starch with water to a thin milk, and stir this into the glue solution, and keep the mixture at the boiling point for a time. Stir in a few drops of carbolic acid, and store in covered vessels to prevent loss of water. It will not sour.

(23) J. R. E. asks: How can I find the north pole of a permanent bar magnet, without using another magnet having its poles marked? A. By noticing the direction in which it settles when suspended by a silk thread about one yard long; one end of the thread being tied around the middle of the length of the magnet, and the other end held in the hand. The end of the magnet which points to the north pole of the earth is in this country called the north pole of the magnet; but in France it is called the south pole, reasoning from the fact that unlike poles attract.

(24) C. R. asks: 1. What liquid is used in connection with silver solder for brazing band saws? A. A saturated solution of bi-borate of soda in rain water. It is used simply as a flux to dissolve the oxide of the heated metal. 2. Can copper be used in place of silver solder with as much success? A. It is liable to make the joint brittle. The best of materials should be used in making this joint.

(25) D. C. W. writes: 1. I made a telephone having a bar magnet wound with ¼ lb. cotton-covered wire, and a tintype plate for the diaphragm. The plate is $\frac{1}{100}$ inch thick, and has some kind of varnish on it. The apparatus will not work. Is the trouble in the wire, magnet, or plate? A. The principal difficulty is probably in the difference between the resistance of the wire on the magnet of your instrument and that on the magnet of the instrument at the other end of the line. The resistance of the wire on the magnet of each instrument—that is, in one circuit—should be equal. 2. The magnet will hold ½ oz. Is that strong enough? A. Hardly.

(26) R. F. S. writes: A friend of mine says that Damascus gun barrels are not made out of Damascus, and I claim that they are. Who is right? A. What are known as Damascus gun barrels are made in England, Belgium, and other countries. The Damascus system is that of twisting square bars, forging them square again, re-twisting and re-forging, and so on; continuing the process as often as required to produce a given quality. This process refines the metal all through, the steel that has at any part of the process formed the corners of the bar being refined by forging.

(27) D. H. asks for a recipe for a cement, to be used cold, for leather; with the requisites of strength, elasticity, and resistance to moisture. 1. Dissolve good glue, previously softened in cold water, in strong acetic acid, over a hot water bath to a thin paste. Strong, but requires several hours to harden. 2. Melt together equal parts of good coal-tar pitch (not tar) and gutta percha; mix well and use hot. Very strong, elastic, quick setting and waterproof. It may be softened with naphtha and used cold.

(28) I. H. B. asks: What is the philosophy of the air chamber on the suction pipe of a steam pump? A. It acts very much on the same principle as the chamber on the delivery pipe, diminishing shocks that would otherwise be produced by suddenly stopping the column of water, and tending to cause a uniform flow.

(29) A. F. asks: Can a ½ inch pipe (80 lbs. pressure) furnish steam enough for a cylinder 3½ x 4½, 225 revolutions, to make 3 horse power? A. It is rather small. It would be better to use a ¾ inch pipe.

(30) D. E. J. writes: I have an engine with cylinder 3 inches diameter and 6 inches stroke, which I intend putting in a boat 15 feet long and 5 feet beam. I shall use paddle wheels, and gear the engine 3 to 1. I intend making a tubular boiler 14 inches diameter and 3 feet long, with 40 tubes 1 inch in diameter, having the draught running the whole length of the boiler, and returning to the smokestack at the forward end of the boiler. With this arrangement, will the boiler be large enough to keep up steam to run the boat 4 miles an hour? A. By using a forced draught, such as can be produced by exhaust steam, probably the boiler will answer.

(31) G. M. H. asks: 1. What sort of steel should I use to make dies for cutting stencil plates? A. Weld Jessup's steel to a wrought iron backing. 2. How should the dies be tempered? A. To a deep yellow.

(32) Z. F. asks how to face grindstones after they are hung. A. Run them dry at a slow speed, and turn them with a piece of 1½ inch gas pipe.

(33) W. F. C. S. writes: I have a fan, the speed of which I wish to double. Will it require twice or four times as much power to run it at the double speed? A. It will take about eight times as much power.

(34) G. A. E. asks: 1. How can the tone of a tuning fork be altered? A. By changing the length, thickness, or width of the prongs. 2. Will the tone of a tuning fork remain the same after years of use? A. When used with care a tuning fork does not change materially.

(35) F. M. suggests that A. H. J. (p. 75, current volume), whose stove pipe acts as a pyroligneous distilling apparatus, should fit the joints upside down, so that the drops will fall within the pipe instead of outside, and that the standing part should slant a little.

(36) W. F. L. writes: I wish to cement an iron to the under side of the bed-plate of a sewing machine to strengthen it. How can it be done? A. One of the best cements for this purpose is composed of melted rosin and plaster of Paris, thinned with boiled oil, and applied warm. The surfaces should be cleaned before application. A few screws or rivets would, however, be preferable to any cement.

(37) A. H. L. asks: What is the method of calculating the chronological cycles, as given in the almanacs? A. The rule for finding what position any given year occupies in the solar cycle is as follows: Add 9 to the date, and divide the sum by 28; the remainder is the year of the cycle, and the quotient is the number of cycles that have elapsed. If there is no remainder the given year is the 28th of the cycle.

(38) H. W. asks whether a square foot of surface near the axle of a windmill exerts more or less power than a square foot at the rim? A. The portion near the periphery is most effective, in windmills, water-wheels and fans.

(39) C. J. M. writes: I have a Bell wire passing over my house, in which the current is reversed at each stroke of the bell. How can I complete a local circuit, without cutting the Bell wire at each stroke of the bell? A. By tapping the main line as follows: Make a metallic connection between one end of a wire and the main line of the Bell circuit, and connect the other end of the wire with one of the two main line binding posts of a relay, and connect the other main line binding post with the earth. If the Bell circuit belongs to other persons, it is unlawful for you to do this.

(40) I. H. asks: 1. Can ice be made thick by pumping water upon it after the pond has frozen over? A. Yes, in some cases; but ice obtained in this way is not very homogeneous. 2. What will be the best method of flooding, so that the ice will not be cut through where it falls from the spout? A. The water may be supplied by a number of pipes, wide planking being laid on the ice in the immediate vicinity to avoid rotting it.

(41) F. A. P. writes: I am casting plates of bent form, which are required to be hard. I have been unsuccessful in chilling them; have greased the mould and heated it before pouring in the metal; imperfect castings always result, the plates being thinner at some places than in others, and cracking in cooling. What is the trouble A. Probably you do not use a proper mixture of iron. Try pouring the metal through several gates, placing them where the castings are apt to crack or cast too thin.

(42) R. L. E. asks how to temper gun springs. A. Heat them evenly to a low red heat in a charcoal fire, and quench them in water with the cold chill off, keeping them immersed until reduced to the temperature of the water. Place an iron pan containing lard oil and tallow, in about equal quantities, over a fire, and place the springs therein, and heat the pan until its contents take fire; then hold the springs in the flames, turning them over and over and dipping them occasionally in the oil to keep them blazing; when the oil adhering to them blazes freely when they are removed from the flames, place them aside to cool off.

(43) J. M. K. asks: 1. Is there a cheap gum which would mix with castor oil to put on belts to prevent slipping? A. The best remedy for a slipping belt is to increase its width, run it over larger pulleys, or cover the pulleys with leather or rubber. There is no preparation to prevent slipping which is cheap in the end. 2. Would it be advisable to run a circular saw, 36 inches in diameter and scant ⅛ inch thick, with flanges 14 or 16 inches diameter, ¾ inch thick at center, and tapering to ¼ inch at rim; would the friction between the lumber and flanges be too great? A. The idea does not appear practicable.

(44) S. W. M. writes: I send herewith a root used as a catarrh remedy. What is it? A. The root is galangal. It comes from the East Indies. It contains a volatile oil, an acrid resin, gum bassorin, lignin, and extractive starch and fixed oil, and a crystallizable body called kampferid. The active principles are the volatile oil and resin. It acts as a stimulant aromatic. It is of small value and seldom employed. It can be bought in the market for 15 or 20 cents a pound.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. D. C.—It contains, besides calcium sulphate (plaster of Paris), glue or size, alum, lime, and whiting or chalk.—S. B.—Chlorite—hydrous silicate of magnesia and alumina, colored with oxides of chromium and iron. Not metalliferous.—E. G.—Rich lead sulphide ore (galena).—W. P.—The rock contains traces of lead, zinc, and iron sulphide.—A. H.—Argillaceous red sandstone.—P. S.—It is zircon-syenite. The red crystals are zircon, a silicate of zirconium.—L. W. J.—The gravel does not contain appreciable quantities of precious metals. The red pieces are jasper.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 15, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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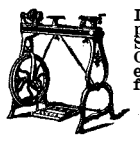

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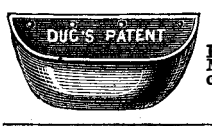

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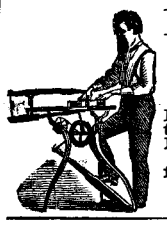

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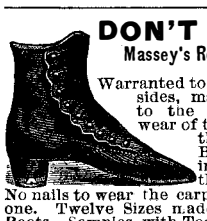

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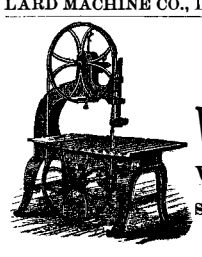

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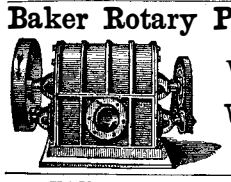

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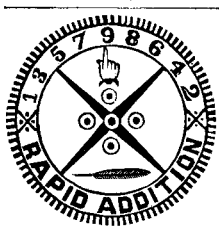

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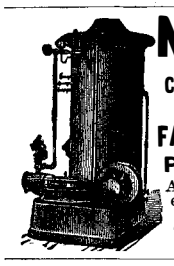

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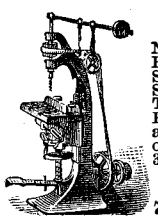
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